THE ENGINEERING RECORD
Published Weekly by the
McGraw Publishing Company
MAIN OFFICES:
114 Liberty Street, New York.
BRANCH OFFICES:
Philadelphia: 929 Chestnut Street.
Chicago: 1140 Monadnock Block.
Cleveland: Cuyahoga Building.
London Office: Hastings House, Norfolk St., Strand.

SUBSCRIPTION RATES:

United States, Canada, Cuba and Mexico....$3.00 a year.
Foreign subscription .... 6.00 a year.
25 shillings. 25 marks. 31 francs.
Foreign subscriptions may be sent to our London office.

NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of The Engineering Record by 10 A. M. Monday of the week of issue. New advertisements can be received up to noon of Wednesday of the week of issue.

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Back Copies.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

Entered at the New York Post-Office as Second Class mail matter.

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Of this issue of THE ENGINEERING RECORD 12,000 copies are printed. Total circulation for 1905 to date, 417,500 copies.

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Shearing Stresses in Masonry.

While the action of shearing stresses in metals has been as fully recognized as that of tension and compression since the establishment of the theory of stresses in solid bodies, they have had practically no place in the rational treatment of masonry structures until the theory and tests of reinforced concrete beams compelled their recognition. In such masonry masses as suspension bridge anchorages, abutments of arches and even in retaining walls, shearing stresses must always exist, and sometimes with comparatively high intensities. The same observation is certainly not less applicable to some portions of high masonry dams. In the latter case shearing stresses have always been allowed for under the head of "friction." In most of the standard treatments of high masonry dams one of the prominent conditions of stability has generally been so stated as to indicate that at no horizontal section of the dam shall the obliquity of the resultant pressure ever be greater than the angle of repose of masonry on masonry, the tangent of that angle being prescribed at about 0.6. Although that has been a general feature of practice in this particular line of construction it is thoroughly irrational, and it is rather strange that so many engineers have sanctioned it. As a matter of fact there is no horizontal joint in any properly built high masonry dam and consequently there can be no possible action of friction until such a joint is made. Hence, before friction can act, an approximately horizontal joint or surface of action must be made by shearing the masonry along that surface. The actual condition resulting from that provision of a specification is the virtual requirement that masonry shall possess a shearing resistance not less than about 0.6 of the resultant normal pressure, and there is little or no first-class masonry used in high masonry dams at the present time which will not fully meet this requirement.

In spite of these conditions a considerable number of engineers experienced in large masonry works have, in the past, not only declined to recognize the shearing resistance of masonry but have asserted that its existence was too uncertain to make it desirable to give it any value. No less an authority than the late Mr. G. Bouscaren, M. Am. Soc. C. E., about ten years ago, treated with contemptuous jocularity the suggestion that shearing should be considered in a mass of anchorage masonry for a proposed large stiffened suspension bridge. Yet it may be stated with perfect truthfulness and without the least exaggeration that no mass of masonry and especially no plain or reinforced concrete beam could stand under severe duty unless its shearing resistance was a large proportion of its compression resistance.

There are few tests of either natural or artificial stones in compression whose results do not furnish a reasonably accurate basis for computing the ultimate shearing resistance. Indeed, the so-called failures by compression of cubical or cylindrical test specimens of nearly all good building stones, whether natural or artificial, are actually shearing failures. Those who have conducted compression tests of stone have many times observed the interesting forms in which the fragments are separated in the fractured specimens. Wedge-shaped pieces are usually sheared off along planes making angles of about 45 degrees with the direction of the applied loads, precisely as the theory of stresses in solid bodies indicates that they should. The manner of holding test pieces prevents these shearing planes from making the exact angle of 45 degrees which theory indicates to be the angle of maximum shearing intensity, but the divergence is small. The crucial fact is the failure by shear, although the maximum test load is recorded in pounds per square inch of compression. It is this persistent neglect to record the failure under its true name which has so long obscured the perfectly obvious action of shearing stresses in masonry.

The primary principles of analysis of tension and compression in any material indicate that shearing stresses exist with varying intensities throughout the entire volume of the piece. An analysis equally clear and but little less simple demonstrates that shearing stresses also exist throughout the entire mass of a beam carrying a transverse load. In other words, every masonry beam, including those of natural stone or concrete whether reinforced or not, must sustain shearing stresses frequently of comparatively high intensity. At the ends of simple supported beams these intensities of shear are sometimes so high that they cause failure. In some recent tests of reinforced concrete beams this failure by end shearing was stated to be a failure by compression in the authentic accounts of the tests. The prevailing obscurity as to shearing stresses in masonry led to erroneous views as to the cause of failure, and the statement was fortified by the observation that the pulverization of the failed material proved the failure to be one of compression. A little experience only is required in testing blocks or cylinders of stone to show that the failed material is always finely divided along the plane or surface of ultimate shearing. The movement of two masses of stone on each other along a sheared surface is bound to pulverize the material. If the stone is weak there may be a large amount of the pulverized material, and it is no exceptional case to find the greater part of the test specimen demoralized in this manner.

Furthermore, it is known that the neutral surface of a bent beam is subjected to the greatest intensity of shear in the entire beam, that intensity having its maximum value at the ends. Every section of the beam parallel to the neutral surface is also subjected to shear, but with a less intensity than that of the neutral surface. Finally, every transverse section of a concrete beam is subjected to a shear with an intensity at the neutral axis equal to three halves the mean.

These considerations show conclusively that the shearing stresses in every masonry mass and in every stone or concrete beam play a part not less important than that of the compressive stresses. They show further that the intensities of these shearing stresses may be subject to computations practically as exact as those which determine compressive intensities. It is obvious, therefore, that the ultimate shearing resistances of various grades of masonry and stone should be as carefully determined by tests as those of compression, and, finally, that the consideration of shearing stresses should govern the design of masonry structures with just as much force and completeness as the consideration of the stresses of compression.

The Importance of Preserving Notes of Electrolytic Damage.

In practically all of the cities in this country in which electric railways have been operated by the single trolley system there has been at least some evidence of electrolytic injury to water or gas pipes. The amount of injury has been much more serious in some cities than in others. The location of the pipe systems and street railway tracks with regard to each other and to the power station, the magnitude of the street railway traffic, the capacity and condition of the return conductor system, and the nature of the soil in which the pipes are laid, each has some influence in determining the nature and extent of the damage and the location in which it will increase most rapidly.

Street railway officials are usually fully alive to the fact that their return currents are causing injury, and for the sake of the owner of the pipes they would be glad to reduce the amount of the injury as much as possible. For their own protection they are naturally anxious to avoid having public attention called to the extent of the damage by the actual bursting of pipes in the streets. The average street railway manager is a competent and well educated engineer, and he knows the electrical condition of his outgoing and return feeders, and the points at which injury to pipes may be expected far better than do the local water works officials. It is entirely possible for him, by overhauling his bonding, or by shifting from time to time the connections to his return conductors, and in various other ways, to divert attention from the injury by diminishing its growth in the territory where it has been most acute. He cannot, however, entirely remove it, nor even reduce it to anything like a negligible amount so long as the grounded system of returns is in use.

The average water works superintendent, especially if his plant be municipally operated, is at a great disadvantage. He knows practically nothing about electricity, is usually not even an engineer, and does not know where to look for damage to his pipes until an actual leak or break directs him to the spot.

In the meantime pitting of the outer surface of mains and service pipes will be going on wherever the pipe system is positive to the rails or earth, and the joints of mains will be more or less affected all over the system wherever the mains are carrying current.

Unless the return currents of the street railways are entirely removed from the ground it is held by a number of specialists in electrolysis to be only a question of time before the pipe owners will be compelled to seek redress from the street railway companies, and although experts will have to be employed in the event of a suit, the water works superintendent must of necessity be one of the principal witnesses as to the facts. He should, therefore, be fully prepared to testify intelligently and accurately in regard to every pertinent fact.

From the nature of the case, the actual damages which he will be able to prove will at best be wholly inadequate, for he cannot see his pipes without going to the expense of excavating to expose them. This fact is, in the opinion of some experts, an additional reason for compelling the street railway companies to entirely remove their return currents from the earth and from the water pipes, for it is in this direction, they believe, that the only hope of complete relief lies.

In order that he may be prepared to convince the court that the injury to his pipes, and the consequential damages resulting therefrom, while they cannot be even approximately estimated, are at least serious enough to justify the court in affording relief, the water works superintendent should have his records so full and complete as to leave no doubt in the mind of the court as to the truth of his every statement. He should not attempt to rely upon his memory. He should cultivate the habit of carefully inspecting his pipes whenever he has an opportunity to do so, and he should promptly and accurately record in a suitable notebook everything of value observed, excluding all irrelevant matter.

The leaves of a notebook found useful for this purpose are ruled in squares, about five to the inch, to enable a rough sketch to be made readily of each point where the main is exposed. This sketch should clearly show the location, with the north at top of page, of the street lines, car tracks, if any, and pipes. If specials or fittings are exposed, these should be sketched in and their sizes noted. The notes should record the date and hour of the observation, the character of soil and of pavement, if any; the condition of the pipes examined, and depth of the deepest pits actually found.

If the superintendent has sufficient knowledge of electricity to make voltmeter measurements, he should also record the difference of potential between pipes and rails, and the drop of potential along the given length of pipe. Arrowheads in the sketch should show just where this drop is measured, and the current flow along the pipe can be calculated in the office and recorded in the notebook. The notes should also show whether the pipes are positive or negative to the earth, or to any other pipes that may be exposed in the trench. Special care should be devoted to examining joints for pittings or leaks. If lead or iron are visible as redeposited compounds in the soil, the fact should be recorded.

Every piece of pipe that has to be removed for repairs on account of electrolysis should be carefully marked and labeled and stored where it cannot be destroyed either by accident or design. The superintendent should be able at any time to absolutely identify every one of his samples of damaged pipe and to produce the notes giving full information in regard to it. While this list of points to be covered sounds long, practice will soon enable the superintendent to make satisfactory sketches and field notes, and on the witness stand they will be indispensable.

The Boiler Explosion on the "Bennington."

The court of inquiry appointed by Secretary Bonaparte has submitted its findings on the cause of the boiler explosion on the gunboat "Bennington" on July 21. It states that the boilers were in fair condition and efficient, considering their age of about fourteen years and the use to which they had been subjected. On the morning of the explosion, after both boilers had been filled and the furnaces started, it was observed that the steam gauge on one of the boilers showed about five pounds pressure. At this time the water tender directed a fireman to close the air cock on this boiler. The fireman climbed up and closed a cock, and almost immediately the steam gauge on this boiler failed to register any pressure. This was apparently not noticed by the water tender or the firemen, and no attention was paid to the failure of the gauge to register, although the men continued to fire heavily. When the gauge on the other boiler showed 135 lb. that on the first still did not register any pressure. An hour or so after starting to raise steam, a leak was observed in the boiler with the gauge showing no pressure, and a message was sent to the boilermaker to come and repair it. Before he arrived the explosion occurred. These are the facts as reported by the court, but as all the men mentioned by name in its report as having taken part in the work about the boilers were killed by the explosion, it is manifest that the full testimony must be published before civilian engineers can wholly accept the explanation, with its seeming proof of inconceivable carelessness.

In all such inquiries it seems to be essential to find somebody on whom to lay blame, and, accordingly, the court has singled out for the part of goat the unfortunate ensign who was serving as engineer officer. It reports that he failed to overhaul at the proper time the safety valve on the boiler which unquestionably blew up first; that he failed to keep the safety valves and the sentinel valves in good working order, and that he failed to test these valves in accordance with the regulations of the Navy Department, for all of which reasons it is recommended that he be brought before a court martial. If there was any reasonable chance that an officer on engineering duty on board ship could have a fair trial before a naval court martial, it would be a most desirable procedure, but as nobody in or out of the navy puts any faith in such methods of settling technical uncertainties, there is really no use in going through with such a farce. The trouble, of course, lies much deeper. Assuming that the court of inquiry has really found the true facts in the matter, the explosion is manifestly attributable to putting a boy in charge of a man's job. There are hardly any manufacturers in this country who would care to put their power plants, of the size of that on the "Bennington," under the charge of a young man just out of a technical school. Yet this is what the Navy Department is now doing without any apparent comprehension of the highly dangerous results that are likely to follow. It is particularly difficult to keep the boilers in our navy in a good condition, and for this reason alone the chief engineer of every vessel ought to be a man old enough to appreciate the responsibilities of his post. As a matter of fact, it is no more just to court martial this young man for not discharging duties which ought never to have been given to one so inexperienced than it would be to court martial the captain of the vessel for not seeing that his engineer officer lived up to the regulations, which is part of the captain's duties, according to that same code.

It is unfortunate that the engineering force of the navy has fallen into such a miserable condition that it is necessary to put a young man without experience in charge of the engine room of even a gunboat. The condition is one that has been slowly growing worse for years. Nominally the best men at the Naval Academy were selected as engineer officers for a time, but the bitter feeling between line and staff reached such a pass that no really self-respecting young fellow could look forward to a career in the engineering bureau except with the greatest repugnance. The abolition of distinction between line and staff in this respect has resulted in putting in charge of the engine room of our vessels many men who have little more than a rudimentary knowledge of their duties, and probably in some cases could not pass an engineer's examination for a tugboat. Why more accidents do not take place is a mystery. The situation is more ridiculous than any pictured by "Pinafore" and cannot be excused by the ability of some officers to dance well at Newport and Bar Harbor. The remedy must be found in some way of making the line understand that it is serving the country whose uniform it wears and not the interests of its own numbers. When an engineer officer is treated by the line as his rank, education and responsibilities deserve, the engineering question in the navy can be settled in quick time, but until there is more patriotism and less corps selfishness the country must expect troubles in the engine room.

A British Bill Against Professional Grafting.

It will doubtless be recalled by some readers that a few years ago Lord Russell, of Killowen, endeavored to secure the passage by Parliament of a bill to prevent professional grafting by means of secret commissions. This bill attracted much attention at the time, but was eventually lost to sight. Evidently it remained to memory dear, however, for it is again up for consideration in a modified form, although there seems to be no likelihood that it will ever become a law, not only because Parliament is too much burdened with more important matters, but also because it is pretty difficult to persuade a legislative body to pass laws which refer about as much to professional ethics as to abstract right and wrong. Then, again, there is a feeling in some circles in Great Britain, just as there is in the United States, that commissions are permissible, even if they are not all right. Years ago a man was riding on an American railway with the manager of the company. The conductor came through the car collecting cash fares about as often as tickets, for those were the days when cash fares were not uncommon. This conductor was a very pleasant man, carrying the weight of considerable jewelry without much labor. At the end of the line the traveler noticed that he stepped into a neat buggy and drove off behind a fine pair of horses. The traveler suggested that the conductor was probably a pretty expensive man for the company to keep on its payroll, but the manager assured him that the contrary was the case, since the fellow had made his pile, being only moderately ambitious, and, moreover, he was such a jolly man that he drew considerable high-price short-haul business to the road.

In the same way a good many people consider themselves entirely justified in engaging an engineer or architect at $150 to $250 to do work worth ten times as much, because, they say, the commissions will amount to so much that there is no use in paying their professional man more than a small sum as an honorarium, so that he can do business with the supply men and contractors on a well-established footing. It is unfortunate that this opinion still exists, but there can be no question that it does, although it is fast disappearing. Whether any laws can help in speeding its disappearance is decidedly questionable, however, as is manifest from the failure of laws to prevent criminal acts. It is apparent from comments in the British papers on the proposed bill that the client has the same recourse there against a commission-taking professional adviser that is available in the United States. That is to say, when a client finds that a professional adviser employed by him has received commissions on supplies furnished for this undertaking he can recover these commissions. This is well established, but the difficulty is to prove that a commission has been given, for these are often so arranged that the transaction involving them cannot be proved.

One kind of unprofessional practice against which the British bill is particularly pointed is that which arises when an expert opinion is rendered on some apparatus or project with which the professional man is interested, although this fact is unknown to his client. This pernicious practice cannot possibly be prevented by laws. For many years Congress and the State Legislatures have been passing laws forbidding public office holders to have any connection with companies engaged in business relations with the nation or the States, yet these laws have been of very little value in checking this evil, which is being reduced by the strength of popular condemnation rather than the fear of fine and imprisonment.

The great trouble is that a few men taking commissions bring the whole profession into disrepute, and lead supply men to send out the broadside offers of commissions which were so disgracefully frequent some years ago. They have not yet wholly disappeared, and only a few days ago one of the members of the staff of this journal received such a circular requesting him to use his good offices in introducing certain lines of earth-handling machinery on any contracts with which he was connected in an engineering capacity, being assured that any assistance of this sort that he might render would be substantially remembered by the firm sending the circular. This was a printed circular, evidently intended for broadside distribution, which shows that there is at least one firm that has found it worth while to offer substantial inducements for such improper aid.

The solving of the trouble rests with the client in about every case, for if he pays suitable fees for professional work there will be little of this grafting by commissions. This has been the decision reached by the railway companies, whose employes were formerly notorious for requiring commissions on everything that was bought by them. These companies have materially raised salaries in the last fifteen years, thereby attracting to their work a much better class of men, to whom a bribe of this sort is most repugnant. Not only has the improvement in the personnel of the companies raised the character of their professional work, but it has also compelled the supply men to spend more money on their goods and less on commissions, thereby improving the quality of the material used by the railroads. This has been a most welcome change to the supply houses, for there are very few business men who relish the old order of doing business. It is in this way that the evil is gradually being abated, and it is hardly possible for any laws to be of much assistance in the process. It is entirely idle to expect it to disappear, but the situation is being improved at a fairly satisfactory rate.

Notes and Comments.

The Pontine Marshes are to be drained by a German syndicate headed by Baron von Donath, which has just made a contract with the Italian nobles owning the property for doing this long-needed reclamation work. These are the marshes which distribute malaria through the region about Rome and have been the greatest influence in retarding the development of the district. The law authorizing the improvement is an old one, but it is reported that the wealthy owners of the land have never seen fit to undertake the work because they used considerable portions of the land as game preserves. It is stated that the work of drainage will be done for a percentage of the reclaimed land, no money payment being required. The work, if it is carried out, will be the execution of a project talked about for centuries, but always postponed by the "dolce far niente" policy of the Italian landowners down to the present generation.

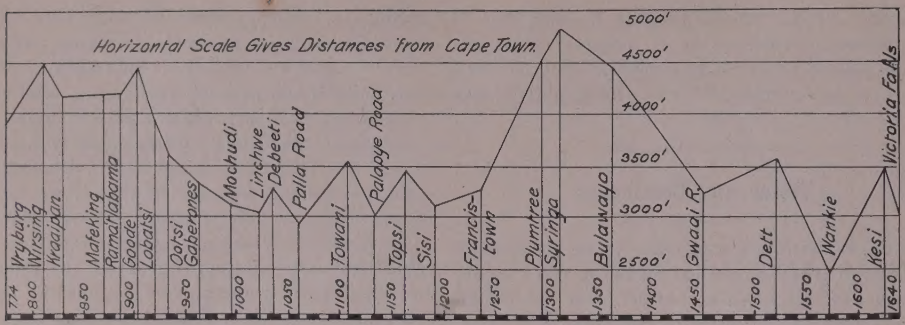
A Rock Slide which recently killed a number of men in the quarry of one of the mills of the Lehigh Portland Cement Co. was caused by an unusual formation. There was a seam or crevice in the quarry dividing the limestone from the cement rock. On the surface this seam had a perpendicular appearance, but from the slide of stone it was found that for about forty feet down the seam was straight and below that for about forty feet the cement rock came in toward the quarry at an angle of about 45 degrees, so that the large ledge of limestone had been left V-shaped, i. e., about three times its width at the bottom than it was at the top of the ledge. This V-shaped ledge of lime rock was resting on the cement rock with an angular foundation of 45 degrees. The wet weather had caused water and clay to wash into the seam, making it slippery, so that the limestone took a slide and toppled over into the quarry, thus burying the men at work in the quarry near the face.

Electric Pipe Thawing has been successful in Ottawa, Can., according to City Engineer Newton J. Ker. Current is taken from the wires of the Ottawa Electric Light Co. and reduced by transformers to about 25 volts. The company charges $1.50 an hour for current and apparatus. One wire is connected to the service in the house and the other to the stopcock box in the street, an adjoining service or the nearest street hydrant, the object being to have a connection on either side of the frozen section and as close to it as possible. The electric current sometimes cleared the pipe in thirty seconds, but if the service was long and frozen solid it varied from that to thirty minutes. Where couplings with a leather washer are used at the stopcock boxes the current will burn out the washer and cause a slight leak. Where the coupling used is of brass and lead the current causes no leak and no damage is occasioned the service, except in isolated and difficult cases where more than 25 volts are used.

The Size of Generating Units in a central station is discussed admirably in a recent issue of the "Electrical World and Engineer," which points out the important results that follow from the introduction of the steam turbine and the rational design of reciprocating engines for such use. With either of these prime movers there is little change in efficiency when the load falls off considerably from its nominal full rating. If a station of 12,000-kw. capacity is built with four 3,000-kw. units, it will probably turn out its total energy at a lower cost than eight 1,500-kw. units. The expense of the former arrangement would be so much less than that of the latter in machinery, switchboard and foundations that it would more than offset any difference in light-load efficiency. This improved situation in plant design has come about not only by improvement in the light-load working of the prime movers, but also by the improved methods of distribution which have rendered one class of units applicable to all kinds of work. The weakest point of central station working today is the complicated and fussy distribution system generally remaining as the heritage of partial reconstructions and reorganizations.

Temporary Terminal Facilities have been constructed by the Lackawanna R. R. at Hoboken with a celerity that even the most fault-finding commuter is praising. On the night of Aug. 7 one of the company's ferry boats caught fire and in a short time the old terminal was completely burned down and out. The company's new immigrant building of concrete and metal checked the fire on one side, and steel pier sheds of a transatlantic line stopped it on the other side. There were no terminal facilities whatever left for handling the 120,000 Lackawanna passengers who go to and return from New York daily. By 4 o'clock in the morning of Aug. 8 Vice-President Loomis had several hundred men at work cleaning up and by the afternoon the regular train schedule was again in force. Temporary buildings of a pleasing appearance have since been erected, and they have been so arranged that the construction of the new terminal building, already described in this journal, will be carried on with less inconvenience to the passengers than would have been possible with the old structure that was burned. All this rush work has been done under the direction of Chief Engineer Lincoln Bush and Mr. J. E. Schnell, superintendent of piers, who have well earned the hearty praise the patrons of the road are giving them.

The Cement and Concrete Investigations to be made during the next twelve months by the U. S. Geological Survey's laboratories for testing structural materials at St. Louis are of a most comprehensive character. They may be grouped under four general heads: 1, the examination of the constituent materials of mortar and concrete; 2, tests of mortars; 3, tests of concrete, and 4, tests of reinforced concrete beams. For the purpose of the first group of studies, sands, gravels, stone, screenings, slags, cinders and other materials will be collected by a special representative of the laboratory and submitted to both physical and chemical tests. The tests of mortars will be made on materials selected so as to be typical rather than unusual in character. These experiments will show the tensile, compressive and transverse strength, yield, porosity and permeability of various mixtures. The tests of concrete will include not only the usual determinations of the tensile, compressive and transverse strength of various mixtures, but also investigations of their absorption, weight, porosity, permeability, resistance to heat and cold, and metal-protecting properties, the effect of vibration on them and the adhesion of metal to concrete. It is also proposed to make a comprehensive series of tests of the strength of concrete beams and building blocks. Under the fourth group, tests will be made to determine the effect of varying percentages of metal reinforcement in the bottom of reinforced beams, and varying percentages of metal in both top and bottom.



Profile of Rhodesia Railway from Vryburg to Victoria Falls.

THE RHODESIA RAILWAYS, LIMITED.

A Description of the Railway from Vryburg to the Zambesi and Beyond.

An entire absence of navigable rivers and the difficulty and expense of road making over the vast, sandy and waterless stretches of country have rendered the construction of railways in South Africa of premier importance. The politics of the country have devolved upon railways, and ministers have come and gone on their "railway policy." It is, therefore, fitting that such a far-seeing imperial statesman as the late Cecil John Rhodes should have early discovered that railways must follow hard upon the track of the pioneer. The difficulty lay in the expense, for, in the earlier days, the conservatism of the country's engineers had the tendency to involve the various colonies in the construction of railways of a heavier and more expensive type than the volume of traffic warranted. As indicative of this it may be mentioned the railways of the Natal, Transvaal and Orange River colonies have cost £15,000 a mile, those of the Cape Colony £10,000 a mile, while the line with which this article deals has cost £3,000 a mile to construct.

In 1889 the northern terminus of the Cape Colonial Railways was at Kimberley, 647 miles from Cape Town, and it was in this year and from this point that Mr. Rhodes entered upon his great trans-African railway scheme and for the opening up of the vast hinterland now known as Rhodesia. His first step was the building of a line to Vryburg, 127 miles north of Kimberley, and thus overcome the difficulties of transport across the Vaal and Hartz Rivers, and over the heavy, sandy and waterless roads intervening.

In this enterprise Mr. Rhodes was fortunate in securing the services of a Cape Government engineer, who had realized that in the development of a new country by means of the railways, economy and rapidity of construction were of the first importance, and, exclusive of the Vaal River bridge, the 127 miles were laid in under 12 months, at a cost of £4,500 a mile. Upon completion this line was purchased by the Cape Government Railways and added to their main line.

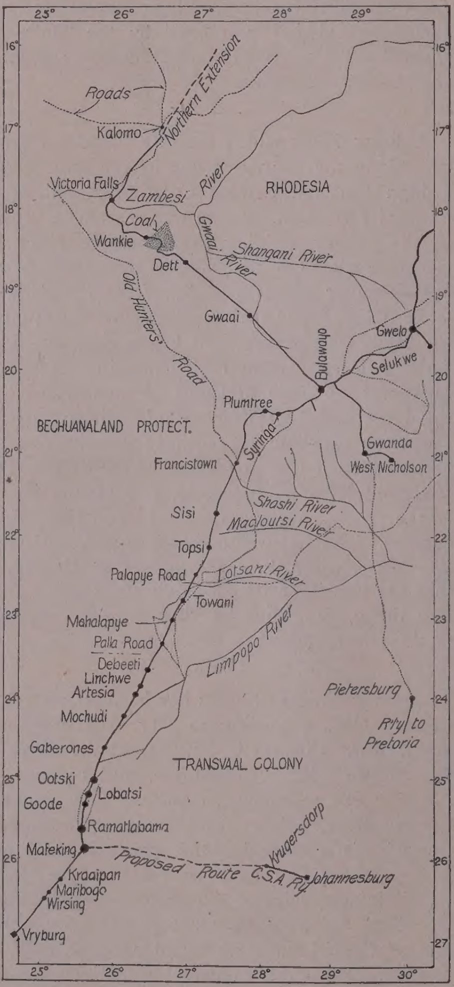
A further advance was made in August, 1893, and the 96 miles from Vryburg to Mafeking was completed in October, 1894.

Meanwhile the pioneer expedition which started from Kimberley in 1890 to colonize Mashonaland had carried out its mission so successfully that the necessity for railway communication with the North became pressing, whilst the war, which resulted in the overthrow of Lobengula and the acquisition of Matabeleland, rendered further progress with the railway imperative.

Early in 1896 the railway construction started from Mafeking, and as the settlers in the new countries were then facing an outbreak among their cattle of the deadly Rinderpest, which paralyzed transport, a very critical situation presented itself, more especially as this disaster was followed closely by the Matabele rebellion.

Mr. Rhodes determined that the railway must reach Bulawayo before the end of 1897, and this the contractors, Messrs. Pauling & Co., Ltd., undertook to accomplish. Plate laying commenced on April 11, 1896, and was pushed on with such rapidity that the rails reached Bulawayo on October 19, 1897, the 492 miles of plate laying having been performed in 500 working days.

The intervention of the Anglo-Boer war prevented further progress for some time, but a forward move was commenced in May, 1901, and the first section of the Bulawayo-Zambesi line was opened to Wankie Coalfield, 1,572 miles from Cape Town, on December 1, 1903. Here a practically unlimited coal supply, so important a factor in railway development, was rendered accessible, thus obviating the delay and expense of hauling coal from the Transvaal mines, some 1,500 miles distant.



Sketch Map, Rhodesia Railway.

No time was lost in pushing forward with the construction, and on April 25, 1904, the rails reached the magnificent Victoria Falls, 1,640 miles from Cape Town.

Although Mr. Rhodes had passed away ere this portion of his far-seeing scheme had been consummated, the spirit of development by railways was sustained. Today the rail head is 100 miles beyond the Zambesi, and by July, 1906, will have wandered another 260 miles into the interior, thus completing 2,000 miles of unbroken railway communication in the great "Cape to Cairo" undertaking, which promises to become "un fait accompli" within the present generation.

Before proceeding to give details of construction it may be desirable to mention the governing principles which were laid down for the guidance of the engineers in charge of the work, as well as some of the specifications to be complied with.

Rapidity of construction was of the utmost importance, as any delay might have seriously retarded the opening up of the country. Economy was likewise essential, as an expensively constructed line would have made the provision of the necessary capital a difficult matter, besides which the prospect of the railway being able to pay interest had not to be lost sight of.

It was recognized that, providing gradients and curves were not sharper than is usual on lines of 3 ft. 6 in. gauge, it would be easy to improve the standard of the road from time to time, according to the volume of traffic. Banks could be raised and widened, additional waterways and more ballast provided, and new stations or crossing places built according to requirements.

The specification provided for all works necessary to insure a "line of railway which would be capable of effectually conveying traffic at a speed of 12 miles an hour on completion, and that the standard South African railway gauge of 3 ft. 6 in. be adhered to."

Provision was also made for the formation work of embankments and cuttings to be 9 ft. wide up to a height or depth of 1 ft., 10 ft. wide up to a height or depth of 3 ft., and for heavier work 12 ft. wide.

Ballast was only to be used on such portions of the line as was necessary to insure the safe running of trains during the rainy season; that is, where black, boggy soil was traversed. The quantity was not to exceed 15 cu. yd. to the chain of 66 ft.

As regards plate laying, it was specified: "It being of the utmost importance to push plate laying as speedily as possible, the contractor shall be at liberty to perform this work in the manner which he considers most desirable to effect the object in view. Temporary river crossing with 4 per cent. grades to be permissible."

Bridges and culverts were to be built of timber and of sufficient height only to carry off the flood water, the permanent masonry and ironwork being undertaken immediately after the opening of the railway.

Construction.—In laying the road very little regard was paid to formation, and wherever the surface of the ground was even it was followed, sleepers being packed up with a minimum of ballast to give a moderately smooth running top.

Plate Laying.—The Vryburg-Mafeking section was originally laid with rails, 46¼ lb. to the yard, but was relaid with steel rails of 60-lb. section in 1902, to correspond with the standard adopted on the northern extension.

The Mafeking-Bulawayo section was constructed with steel Vignoles rails, in 30 and 33 ft. lengths, of 60-lb. section, connected by fish plates weighing 15 lb. per pair, with 4 bolts to each joint. Steel trough sleepers of Indian-State pattern, 68¼ lb. each, laid 1,940 to the mile, were used throughout. These sleepers answer very well, and when properly packed a good road can be easily maintained.

Wooden sleepers were impracticable owing to the ravages of white ants and other termites. Baltic creosoted pine cross-ties, protected from fire by sheets of zinc, are, however, used for crossings and over bridges and culverts.

During construction this type of permanent way lends itself to rapid plate laying and alignment, as much as 4.1 miles having been put down in one working day.

Mile and quarter-mile posts are fixed throughout.

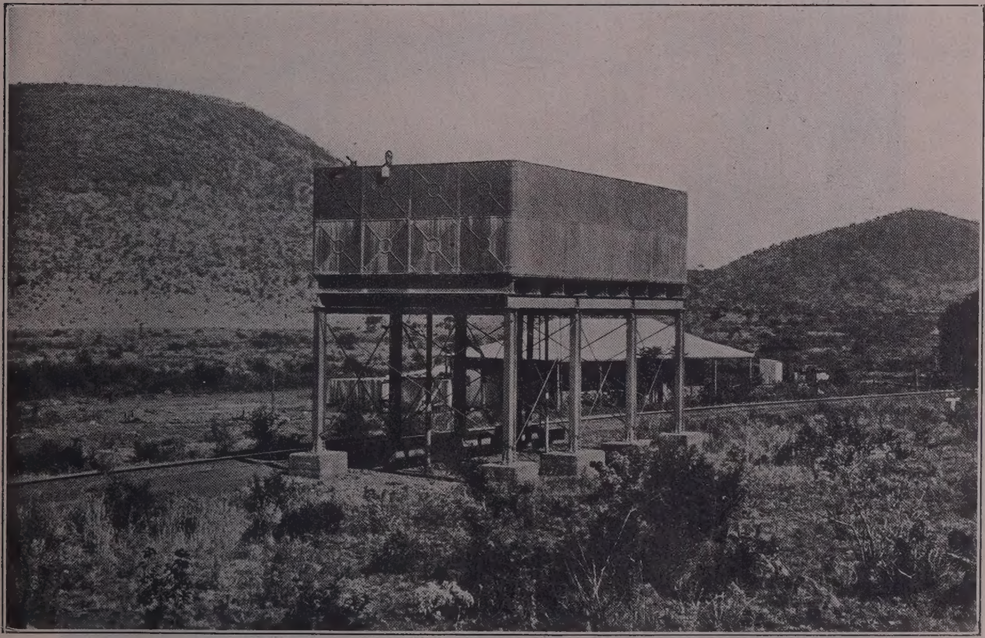
Ballast.—Owing to the dryness of the climate and the adaptability of steel sleepers to almost any kind of ballast which would pack closely, no serious consideration of this item was necessary. All that was required was usually obtainable in the excavation of side drains, etc., and except where passing through the lower levels over loamy soils, ballast was not supplied in greater quantities than specified, viz.: 15 cu. yd. per chain of 66 ft.

It was found that broken limestone and gravel, which was nearly always found by excavating at the side of the formation, made the best ballast. A sand belt of 80 miles is traversed on the Vryburg-Bulawayo section, and here the road was ballasted with the sand, which packs firmly. On the Bulawayo-Zambesi section the road is sand ballasted, except for about 50 miles.

Land.—As regards land, a strip 300 ft. wide was allotted to the railway, i. e., 150 ft. on each side of the center line, except where more is required for stations and buildings. As a precaution against fire and to afford a better view of the line to enginemen, the grass and trees within this strip are cut down.

Fencing.—The line is practically unfenced throughout, except in the vicinity of stations and buildings and over a few farms traversed by the railway, the farmers having the right to demand fencing of the railway line through their farms upon payment of one-eighth of the cost.

Telegraphs.—The telegraph line was constructed at the same time as the railway and is the property of the government. It serves for both railway and public purposes.



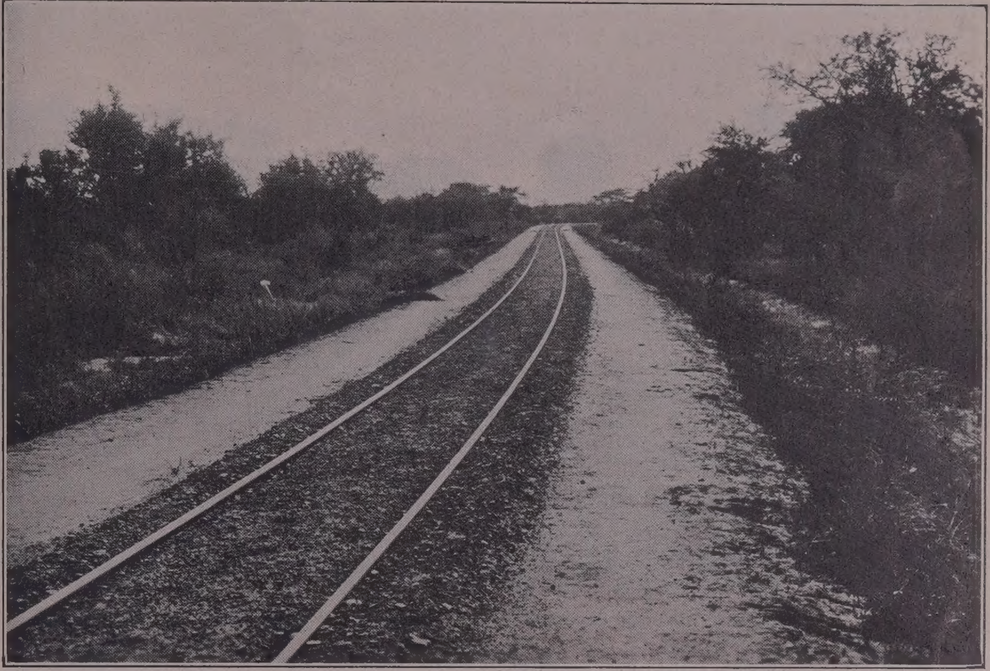
Water Tank Holding Thirty Thousand Imperial Gallons.

Bridges and Culverts.—Waterways of all sizes and descriptions were provided wherever necessary, the longest single span being of 100 ft., with lattice girders. Concrete was largely used, mixed in the proportion of 6 stone, 3 sand and 1 Portland cement. The larger bridges and culverts were built in random rubble, quarry-faced granite or sandstone.

Lattice steel girders were used for the 75 to 100-ft. spans and rolled steel joists for 6, 9 and 12-ft. openings.

Wrought iron pipes were largely used in place of small culverts, and were faced at each end with rubble masonry. The following sizes were used: 12 in. diameter, 112 lb. per yard; 18 in., 173 lb.; 24 in., 278 lb.; 36 in., 467 lb.; 48 in., 736 lb.; 72 in., 1,303 lb.

Buildings.—All buildings were originally constructed of an inexpensive and portable character, generally of galvanized, corrugated iron, lined with match-boarding. This step was fully warranted, as many of the buildings were erected at points which proved unhealthy, and it facilitated the removal of the structures to healthier sites or to points where traffic requirements became more apparent. Now that the exigencies of the railway working are better known, these temporary structures are being replaced by permanent brick buildings.



A Typical Bit of Road on the Rhodesia Railway.

Water Supplies.—Water supplies were provided, as nearly as possible, at intervals of 40 miles. The water was pumped from a river, well or borehole and stored in wooden tanks where necessary. Cast-iron overhead tanks of from 20,000 to 30,000 imp. gal. capacity have now replaced the wooden ones, while concrete walls have been constructed across many of the rivers to conserve the water during the dry season. Rain falls between the months of November and April and averages 24 in. a season, most of the rivers drying up for the rest of the year.

Stations and Sidings.—Telegraph stations are established at intervals of about 40 miles, with intermediate sidings or crossing places averaging 10 miles apart. The traffic accommodation at these stations usually consists of a passenger loop, 1,122 ft.; freight loop, 1,056 ft.; dead end, 363 ft. in length, with passenger platform 264 ft. long, 14 in. above the rail level and faced with brick.

Quarters are provided as required for traffic and other resident officials, together with the usual offices, refreshment rooms, etc.

Intermediate crossing places consist of a loop about 924 ft. between clearance pegs, usually with a dead end of 330 ft. No platforms or buildings are provided.

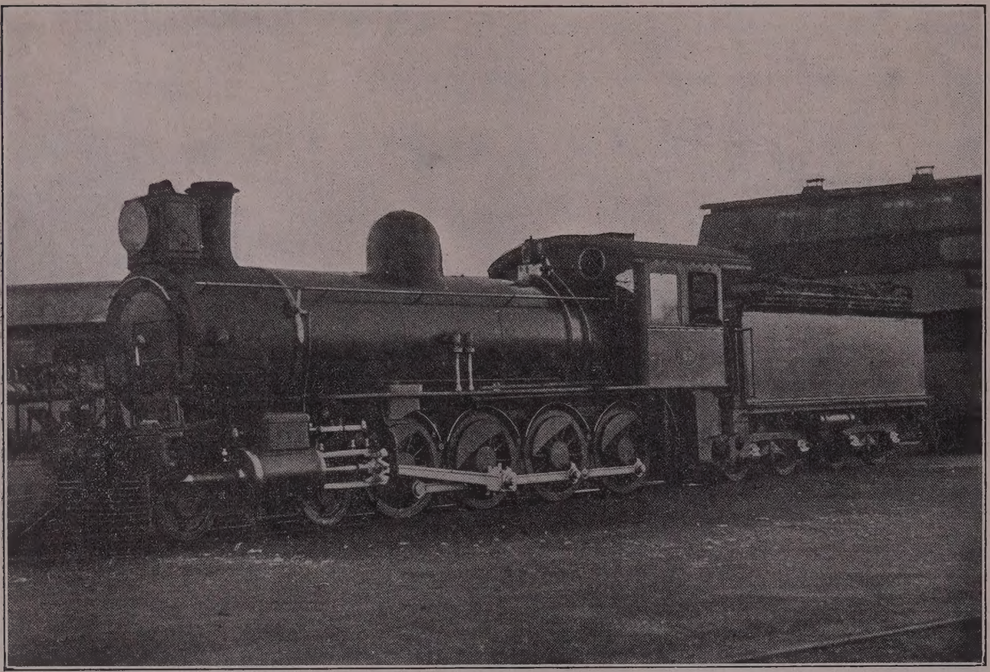
Method of Working.—Regular trains are run to a working time-table, and each irregular train to a special train notice, showing the places where trains are appointed to cross or pass one another, while canceled train notices are issued to set forth any regular train which will not run.

Every train, before leaving a telegraph station, must be in possession of a written order to proceed, setting forth the point at which opposing trains, if any, are to be crossed, or following trains allowed to take precedence, the consent to and confirmation of such an order having been obtained by means of the telegraph from the telegraph station in advance.

Signals are only provided at the telegraph stations.

Engine depots are established at Vryburg, Mafeking, Bulawayo and Victoria Falls, trains between Vryburg and Mafeking (96 miles) being worked with single crews. Between Mafeking and Bulawayo and Bulawayo and Victoria Falls (490 and 280 miles, respectively) trains are worked by double crews in 8-hour alternate shifts, the crew off-duty being located in a caboose containing sleeping, lavatory and cooking conveniences. The same engine and crew perform the round trip of 980 or 560 miles, respectively, and usually lay off for a few days before commencing another trip.

This system of running locomotives for a thousand miles continuously has its drawbacks, and the wear and tear on tires and machinery is considerable, but the average run of 60,000 miles between visits to the shops may be considered satisfactory.



Standard Passenger Locomotive, 93 Tons Weight, Rhodesia Railway.

When the line was first laid engine depots were built at intermediate points and short trips made with single crews, but owing to the unceasing prevalence of fever and sickness at these depots the utmost difficulty was experienced in maintaining a staff, and this with the scarcity of locomotives, the then scanty water supplies and the heavy cost of upkeep of the depots, soon rendered the introduction of long runs and the caboose system an absolute necessity.

The intermediate engine depots have now been abolished, except at Mahalapye, which is still retained for coaling purposes and as a depot for an auxiliary locomotive in case of failure along the line.

Locomotives.—The Standard Locomotives are all of British manufacture, having 8-coupled driving wheels of 4 ft. diameter, with a leading 4-wheel bogie. Cylinders, 18½ in. diameter, 24-in. stroke; safety pressure on boiler, 180 lb. per square inch; heating surface, tubes, 1,184 sq. ft.; firebox, 131 sq. ft.; weight on each pair of driving wheels, 12 tons; weight of engine and tender, 93 tons, or, in running order, about 120 tons; haulage capacity, 500 tons; Sheard injector system, fitted below water level; tender capacity, coal 10 tons, water 27,000 gal.; average fuel consumption per mile run, 64 lb. Wankie coal.

Freight Cars.—There are several kinds of freight cars in use, the prevailing types being:

	Tare.	Load.	Length.
Wooden bogie trucks......	11 tons	25 tons	34 ft.
Wooden 4-wheel trucks.....	6½ "	15 "	20½ ft.
Covered wood bogies......	13½ "	25 "	33½ ft.
Steel bogie trucks.........	12 "	34 "	36 ft. 10 in.

Passenger Coaches.—Three classes of passenger stock are provided, viz., first, second and third, fares for local journeys being on basis of 3d., 2d. and 1d. per mile, respectively; in through journeys slightly less per mile is charged.

First-class stock, 26 tons tare, length over all 60 ft., running on 4-wheel bogies. Each coach is fitted with five or six compartments of four berths each and has two lavatories, water closets, a through corridor and a balcony at each end. The second-class cars are of similar build, with six compartments of six berths each. The third-class cars are of the same dimensions, with sleeping accommodation for 60 persons.

Cattle trucks are loaned from the Cape Government Railways as required.

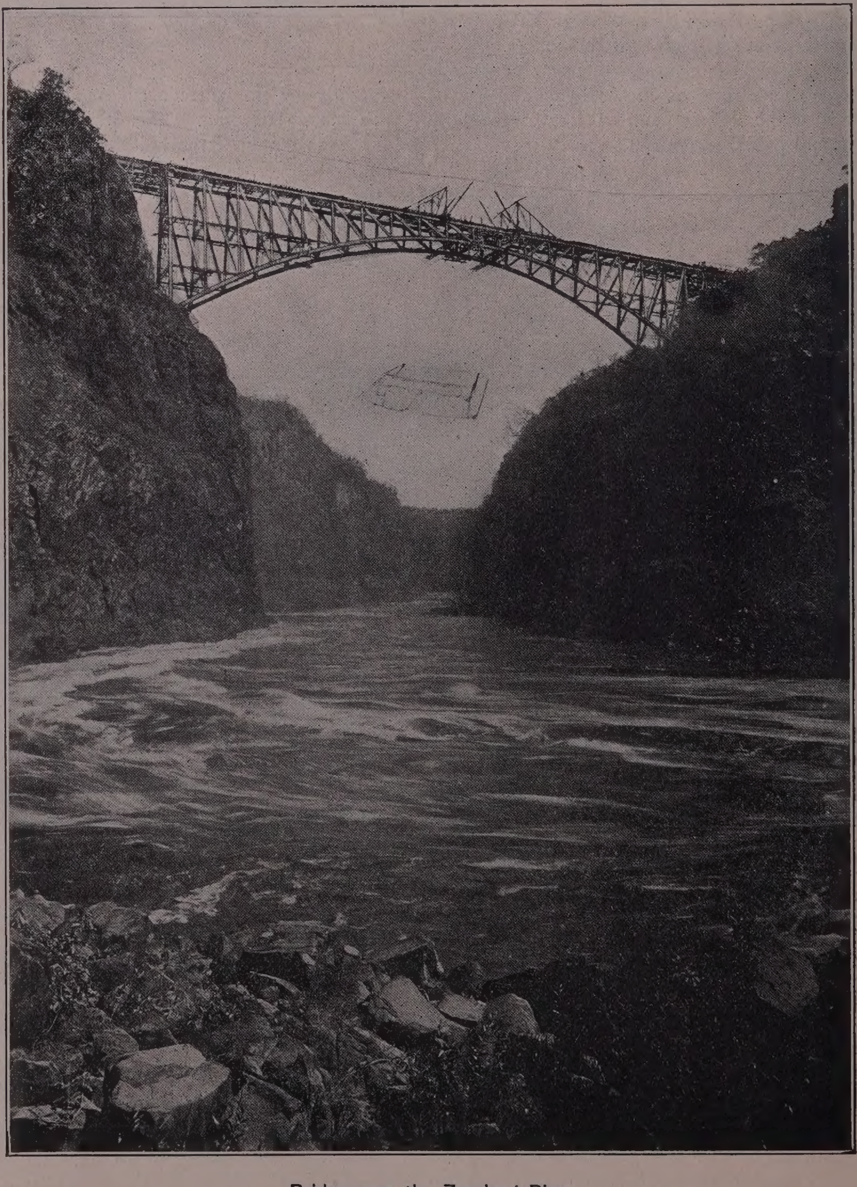
Couplings.—All couplings are of the central buffer type, with link and safety chain, while the lubricating system adopted is the wool and waste packed boxes with axle oil.

Brake Power.—In addition to a powerful hand brake, all vehicles are fitted with Smith's automatic vacuum brake, which can be applied by the guard or driver, and is self-acting in case of accidental parting of the train.

Speed.—The speed of trains is 30 miles an hour for passenger and 20 miles an hour mixed or freight.

(To Be Continued.)

Boiler Plate Experiments have been conducted by Prof. C. Bach, in view of the revision of the standard German boiler specifications, and the results are given in the "Zeitschrift" of the Society of German Engineers. Seven grades of plate varying from 3,400 to 5,200 kg. in ultimate strength had their properties determined carefully. It was found that the total extension on fracture only begins to fall off materially when the ultimate strength of 3,851 kg. is exceeded. The elastic limit only rises when the ultimate strength exceeds 3,651 kg., while the extension at the yield-point only begins to diminish for tensile strengths greater than 4,139 kg. For practical purposes, Prog. Bach, concludes, the toughness of the grades of metal he tested does not diminish sensibly until an ultimate strength of 3,800 kg., 54,000 lb., is exceeded.

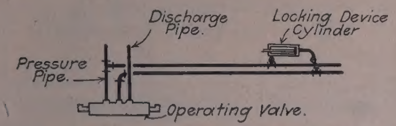


Bridge over the Zambesi River.

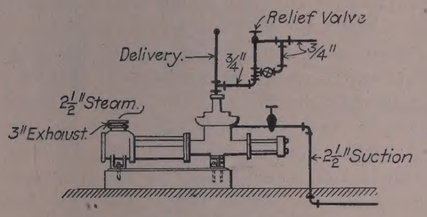
Mechanical Plant of the New York Hippodrome.

The construction of the Hippodrome, the recently completed enormous theatre in New York City, marks a mechanical triumph of high order in bringing into play, in addition to highly developed uses of electricity for theatrical effects, a series of mechanical effects of a variety and extent never before attempted for amusement purposes. In addition to elaborate provisions for lighting, heating and artificial cooling in the summer, unusual arrangements for raising and lowering different sections of the stage, a large tank beneath the arena for aquatic effects, and also an overhead traveling crane equipment for handling scenery are interesting parts of the plant. The installation of these new features was rendered difficult not only by lack of precedent in similar lines of construction, but also by the magnitude of the Hippodrome building and the variety of its equipment, resulting in a magnitude of detail difficult to comprehend. The undertaking is in all respects one of the boldest ever attempted along mechanical lines, but its entire success has proved a certainty from the first performance in the new playhouse, inasmuch as the elaborate mechanical facilities opened up an unexpected range of scenic possibilities.

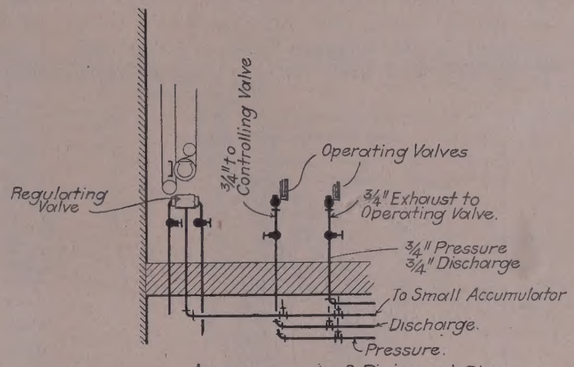
Reference has been made to the steel details of this interesting building in previous issues of The Engineering Record, an article on March 18 showing the immense roof trusses and another on March 25 referring in general to the steel work involved in the structure. As explained in these articles, the Hippodrome has been built to provide for the production of amusements of a scope never before attempted, combining theatrical presentations with those usual in the modern circus. The structure follows very closely the usual lines of theatre construction, yet is somewhat differentiated by its large proportions. It occupies the entire end of the block of the east side of Sixth Avenue, between Forty-third and Forty-fourth Streets, the site having a 200-ft. frontage upon Sixth Avenue and a depth of about 226 ft. The auditorium occupies a space about 160 ft. square in front of the proscenium



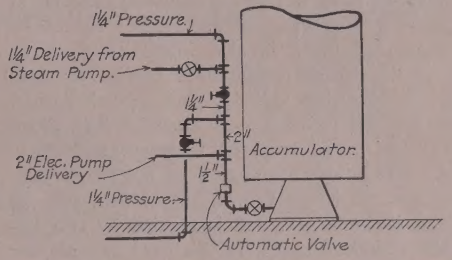
Arrangement of Piping to Arena Locking Cylinders



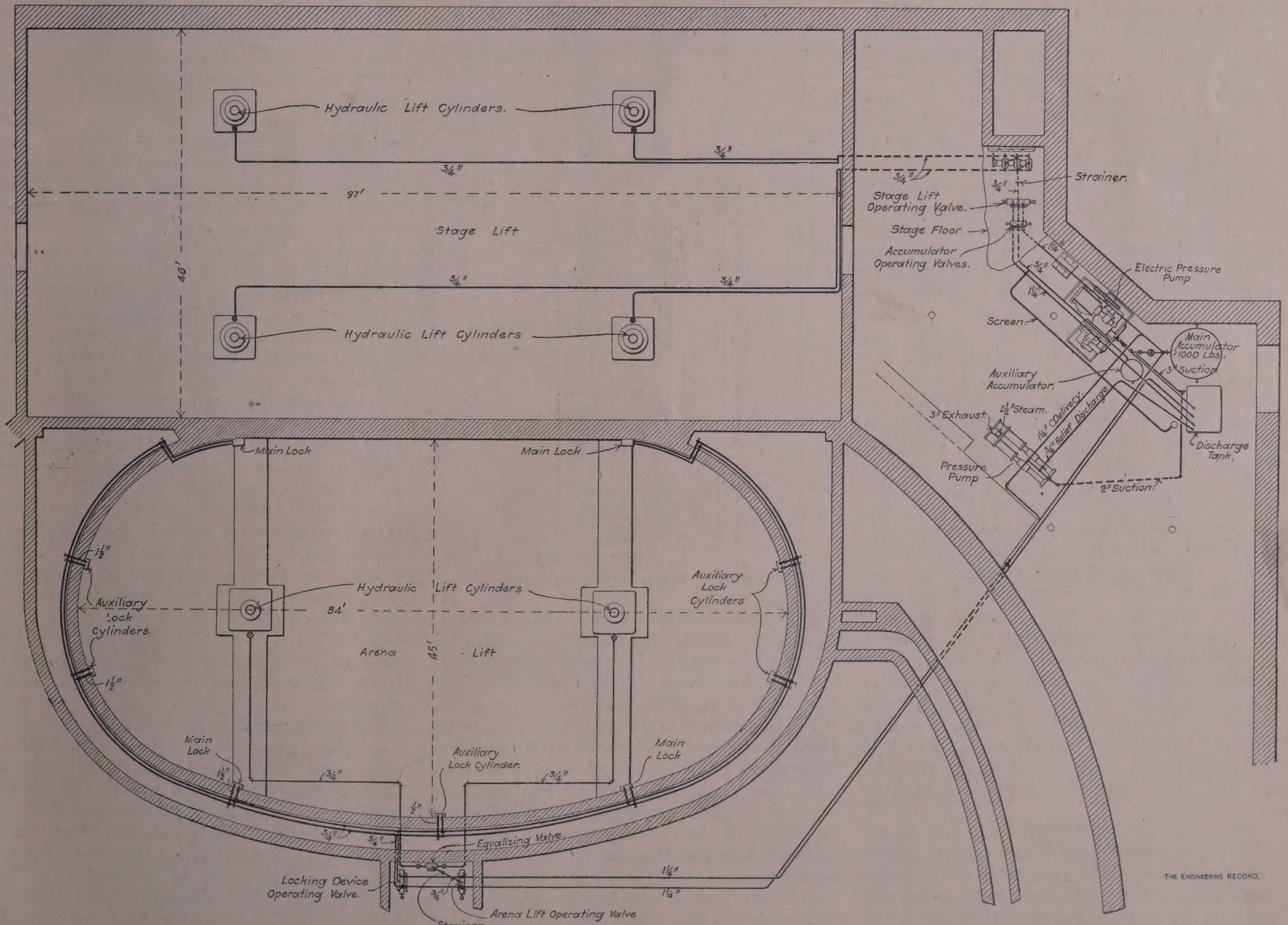
Piping for Relief Valve and By-Pass.



Arrangement of Piping at Stage-Lift Operating Board



Arrangement of Piping at Accumulator.



Plan of Basement beneath Stage and Arena showing Lifting Cylinders and Control Piping.

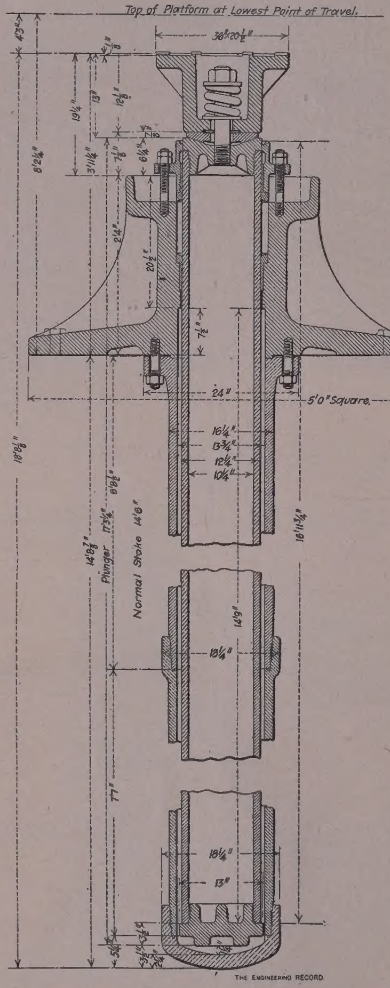
arch, which is 47 ft. from the rear of the building, giving thus a clear stage area of 47x200 ft. The arch is of unusual size, having a width of 92 ft. and height of 37 ft. In front of the stage proper is located an arena approximately 50x100 ft. in size, projecting out into the auditorium, and providing with the stage unusual opportunities for scenic effects. The seating capacity of the Hippodrome is 5,500, of which over one-half is in the balcony and gallery.

The Stage Lifts.—One of the most novel and interesting features of the mechanical equipment of the Hippodrome, particularly on account of its size, is the novel arrangement of the hydraulic lifting mechanisms by means of which the stage and arena platforms may be independently raised or lowered for facilitating unusual effects in theatrical productions. A rectangular section of the stage, 47x97 ft. in size, immediately at the rear of the proscenium arch, is carried on four hydraulic elevator cylinders of special design, which are able to lift it to an elevation 8 ft. above the normal stage level or to any intermediate level. The adjustable section of the arena platform is of an irregular oval shape, with axes 84 and 45 ft. in length, and is carried by two hydraulic cylinders which, in this case, provide for lowering the platform a distance of 14 ft. down into the aquatic basin beneath. The purpose of this movement is to open up the tank below by submerging the platform beneath the surface of the water to any desired depth. Both platforms are equipped with the necessary locking devices for securing them in position and sustaining the loads that may be brought upon them. The details of both the elevating mechanisms and locking devices were worked out especially for this installation by the Otis Elevator Co., and involve many new features.

The arrangement of the stage, arena platforms, pressure pumps and accumulator equipment for operating the elevating mechanisms is shown in the accompanying basement plan of the stage portion of the structure. The hydraulic pressure supply system is located in one corner of the basement near the boiler room, from which the delivery piping is carried in short direct lines to the controlling boards for the two platforms. The pressure pumps are in duplicate, one a Deane triplex pump electrically-driven by a 40-h.p. Otis motor, and the other a Deane outside-packed plunger duplex steam pump, both of which deliver into a common lead of 1½-in. pipe to the accumulator and to the delivery lines to the elevating cylinders. As may be noted from the piping plan in the basement, the system is carefully duplicated and interconnected for reliability of service, each piece of apparatus being by-passed and furnished with connections permitting it to operate independently of the others. The pumps are controlled by the movement of the accumulator, which, when elevated to its highest position, automatically cuts out the pump in operation. Both pumps are also equipped with automatic relief valves, which are arranged to bypass the delivery back into the discharge tank if the pumps should continue working and raise the pressure above 1,000 lb., the normal working pressure.

The high-pressure delivery lines lead to the hydraulic cylinders through controlling apparatus, that for the main stage being at the right-hand side and that for the arena in the prompter's booth in front of the orchestra, as shown in the plan. The controlling apparatus is of a special design intended to constrain the various elevating cylinders for each platform to lift equally upon all sides and corners, and thus raise it uniformly. The hydraulic cylinders involve some radical features of construction, of which the chief is the spring-retained, ball-and-socket setting for the head, which permits of inequalities of level of various corners of the platform without distortion stresses upon the head of plunger. This is accomplished by means of a spherically-faced plate between the head casting and the top of the plunger, the whole being bound together by spring pressure, as shown in the drawings.

A feature of the design of these cylinders used beneath the arena platform is the size of the plunger unit, a single-piece hollow bronze casting nearly 17 ft. long, to provide for a 14-ft. lift, the inside and outside diameters being 10¼ and 12¼ in. The hydraulic cylinders for the stage platform are of exactly similar construction, but of shorter stroke, the latter cylinders being mounted in the basement and projecting only 24 in. below floor level, while the arena cylinders, resting upon the tank bottom, extend nearly 15 ft. into the ground. The plungers of all six cylinders are as nearly in duplicate as possible, all having lifting powers with the hydraulic pressure of 1,000 lb. of 117,860 lb.



Details of Arena Lifting Cylinders.

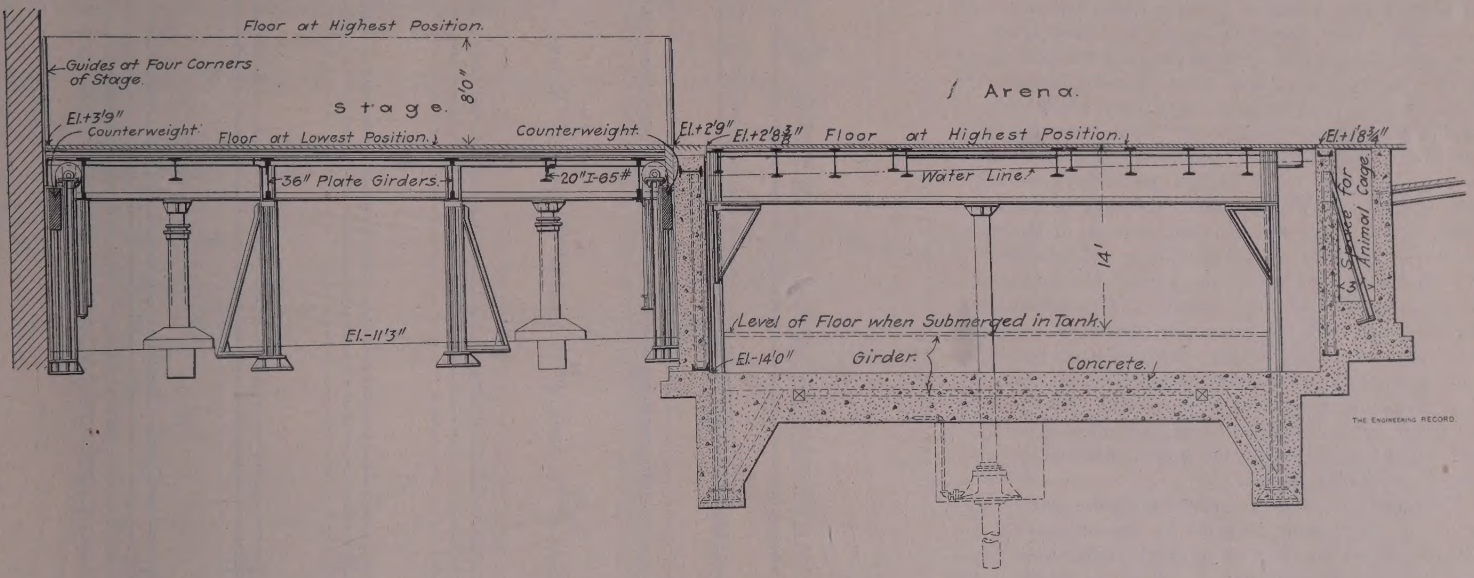
The construction of the stage and arena lifting platforms involved problems of a difficult nature, inasmuch as it was desired to provide for static loads upon each, when locked into stationary position, of 250 lb. per square foot; furthermore, the design of the elevating plungers under the stage platform provides for lifting it with uniform loadings as great as 60 lb. per square foot. Accordingly careful consideration was given to the design of the frames and interesting steel girder structures have resulted. While the stage platform is of somewhat larger proportions than that for the arena, its construction was much simplified by a liberal use of counterweighting and furthermore the use of the four lifting plungers which distributed the loading toward the corners of the framework; the arena platform, being supported by only two plungers and having an oval shape, required a design of much greater complication. The details of these steel frameworks were designed by Purdy & Henderson, New York, designers of the steel framework for the building. The weight of the arena platform with the floor covering is 90 tons, while that of the stage platform is 125 tons; the two plungers under the arena, operating at their maximum capacity of over 58 tons each, are thus ample, while the four stage plungers, of the same capacity, have a reserve margin over that necessary for the counterweighted platform alone to enable a uniform live load of considerably over 60 lb. per square foot to be elevated also.

Special locking devices have been designed to secure the platforms in position when they are used for performances. The arena platform is arranged for locking at its upper position only, inasmuch as it is not used in any of its lowered positions. The stage platform has six equidistant locking positions in its rise of 8 ft., so that it may be used at any of the elevations desired. The details of the locking mechanism for the stage platform are well shown in an accompanying drawing, while the diagrammatic plan of the stage shows the arrangement of the fourteen guiding columns, of which twelve are used for the locking, and of the motor-drive connections for operating the locking bars. In each of these guiding columns a platform strut slides, which strut has arranged at its lower end a horizontally moving locking bar. This bar or dog is extended outward for locking, so as to rest on shelves within the guide column, the construction of which is shown in the detail views of the guide column.

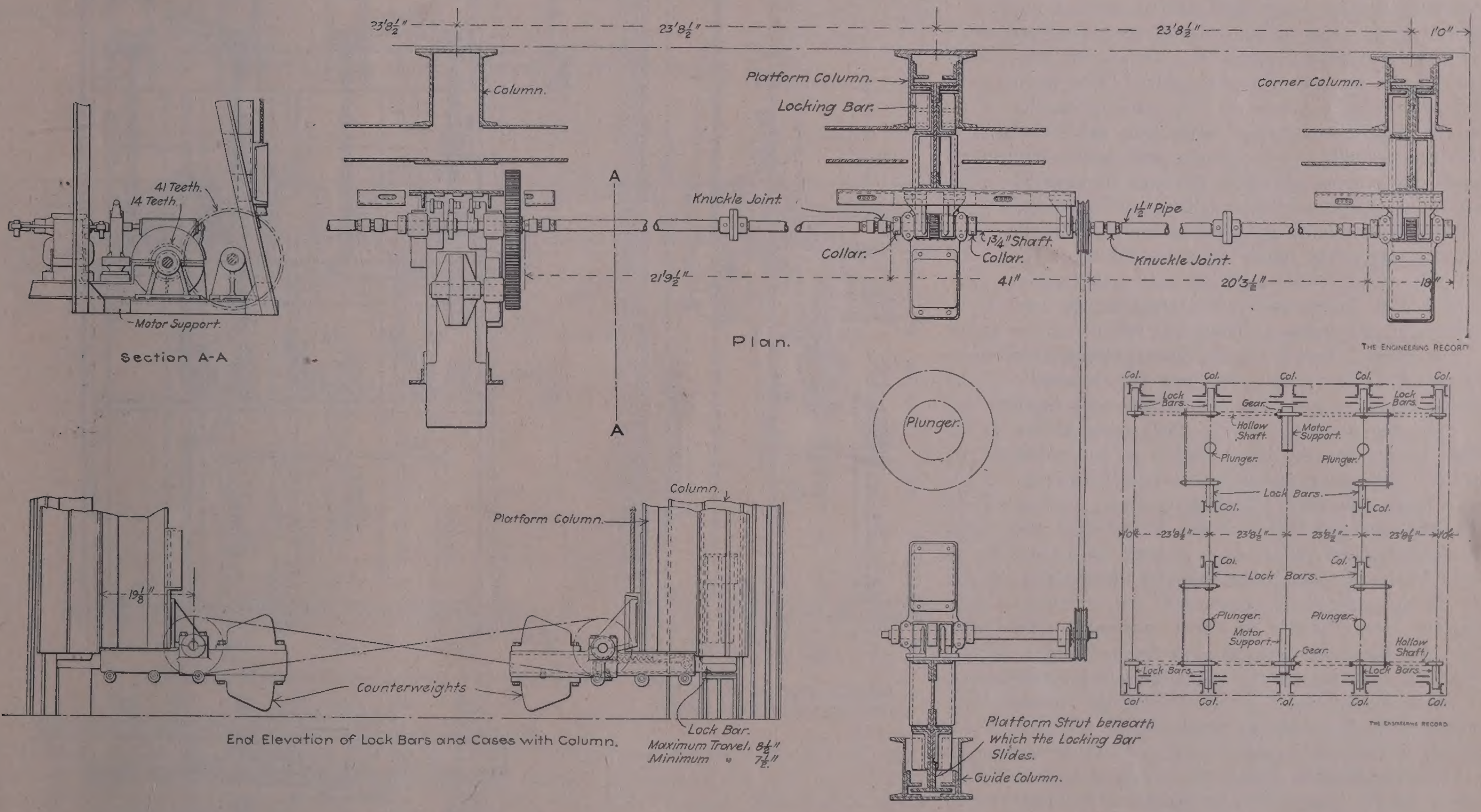
The lock bars are of steel, 3x8 in. in section and 30 in. long, and are carried in a special cast-iron framework, counterweighted at one end. This frame is pivoted concentric with the driving shaft, by means of which the lock is actuated through a pinion and rack on the upper side of the lock bar. The purpose of the counterweight arrangement is to keep the locking frame held normally up against the lower end of the platform strut for correct action in locking, yet to permit of a freedom of movement of the whole frame if by any mistake hydraulic pressure should be applied to the elevating cylinders for lifting before the locks are drawn out; in such a case each locking bar would merely lift its platform strut slightly, and, by virtue of the recessed upper edges of the lock bar nose, slip out without injury to the lock shelf next above. Of course it is not intended that this shall happen, and elaborate precautions are taken in the operation of the equipment to prevent such misuse, but it provides an effective safeguard to prevent the serious damage that would otherwise occur in case of accidental or wilful mishandling. The lock bar has a travel of 8½ in. from locked to unlocked position, stops being located in the frame casting to limit the movement in either direction.

The motor operating the locking movements is one of the elevator type of motor equipments, with worm gear reduction drive, of the Otis Elevator Co. The motor, which is controlled from the operating board for the stage platform, drives through a double reduction, both worm and gear, to the longitudinal shaft operating the lock bars. This shaft is extended from the motor support in both directions through knuckle joints and hollow shafts to drive the four adjacent locks on one side; also, as shown in the diagram, the locks on the two adjacent inside guide columns are driven from this shaft through the double wire rope drive connection which obviates the necessity of more than the two motors for the stage locking. These motors are both series-wound machines and are provided with indicator contacts which show on the operating board by an annunciator device when the locks are entirely withdrawn.

The locking equipment for the arena platform is, in distinction from that of the stage platform, operated hydraulically through horizontal cylinders located around the edges of the aquatic basin. These locations and the piping connections of the various lock cylinders are shown in the basement plan. It will be noted that there are four large main locking cylinders opposite the hydraulic lifting plungers which carry the main load of the arena platform, these locks being so located as to receive the heavy principal plate girder members of this platform. There are also two auxiliary locks at each of the curved ends of the platform and one at the extreme front, these being provided to receive the overhang weight of the curved extensions from the principal members of the platform structure. These locks are all controlled from the promptor's booth, in which the control valve for the lifting cylinders is placed, two pipes being carried out encircling the arena platform as shown. One of these pipes is for the pressure delivery, while the other controls the discharge. These locks for the arena platform are of simple construction, consisting merely of heavy hydraulic rams, the plungers of which are arranged to extend outward from the sidewalls of the basin so as to carry the ends of the girder members of the platform.



Longitudinal Cross Section through Stage and Arena.



Details of the Stage Platform Locking Mechanism and its Motor Drive.

A new design of operating and control mechanism has been installed for the control of the lifting cylinder for both platforms. It is obviously necessary that all plungers of either platform should lift equally to prevent distortion of the platform with possible serious injury to the plungers; this is particularly important in the case of the stage platform, as here four cylinders are used, whereas only two are employed for the arena platform. Furthermore the stage platform has six locking points, and for locking at any of these levels it is absolutely necessary that all corners be brought to the exact level necessary for the locking dogs to go correctly into lock.

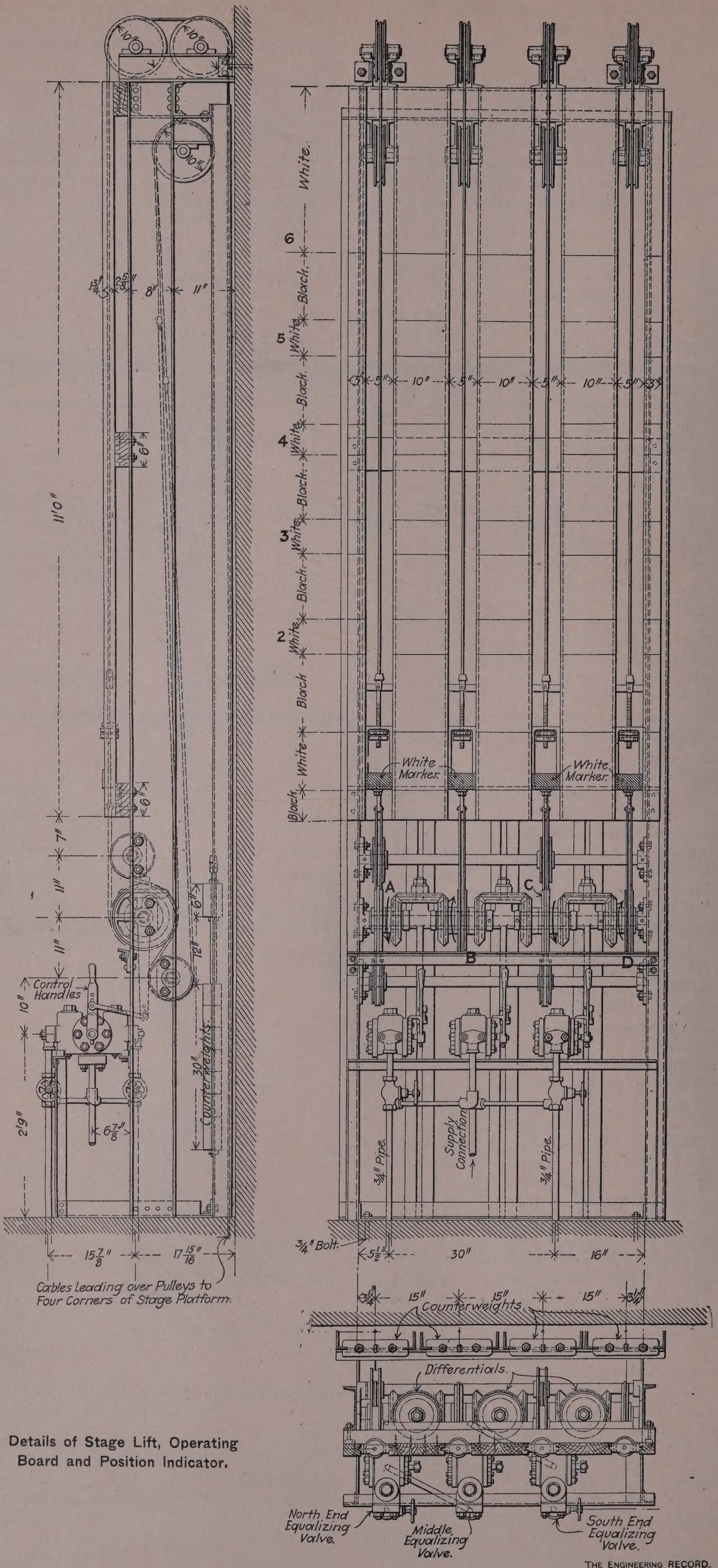
The control mechanism for the stage platform is illustrated in an accompanying drawing. It involves both an indicator or annunciator equipment which, by means of traveling markers, shows at all times the exact relative levels of all corners of the platform, and equalizing valves automatically operated, which tend to prevent unequal movements of the four hydraulic plungers. Wire cables are carried from each of the four corners of the stage platform through the basement and up to the indicator device at the right-hand side of the stage, these cables passing over pulleys at the top of the board and down to indicating slides with white markers. These markers are adjustable and are kept rigidly in position by counterweights at the rear of the board, which operate through extension cables from the lower ends of the markers.

Perhaps the most interesting feature of the control mechanism is the differential gear equipment by which unequal movements of the platform plungers are prevented. These are operated by the connections from the markers to the counterweights at the rear of the board, which connections are of automobile chain and pass over sprockets on the differential gear shaft so as to revolve the sprockets in alternately opposite directions. Thus sprockets A and B, which are connected to the two north corners of the platform, are caused to revolve in opposite directions, so that if these two corners are elevated equally the differential gear connection remains stationary in its vertical position, while if there is any inequality of movement the differential gear and its arm will be moved one way or the other, which movement is made use of in the equalizing valve to slow down the more rapidly moving plunger and hasten the other. The same action takes place with sprockets C and D, which are connected with the two south corners of the stage platform. Still another application of this same principle is made between sprockets B and C, so that any inequalities of movement between the north and south ends of the platform in general will be equalized by the middle differential gear in a similar manner.

The equalizing valves for distributing the water supply of the various plungers by the action of the differential gear are of a simple slide valve type designed to withstand the heavy hydraulic pressure used. The action of each is to cut off the supply to the more rapidly moving cylinder and increase the supply of the one moving more slowly, this being accomplished through the link from the differential gear arm to the control handle of the equalizing valve. The main hydraulic supply connection is made primarily to the middle equalizing valve, this valve distributing equally to the north and south end equalizing valves provided the end movements are equal; if unequal this equalizing valve changes the distribution until equal movement is secured. Then similarly the supply from the middle valve to each of the end equalizing valves is further equalized to insure equal movement of the end corners in the manner above referred to.

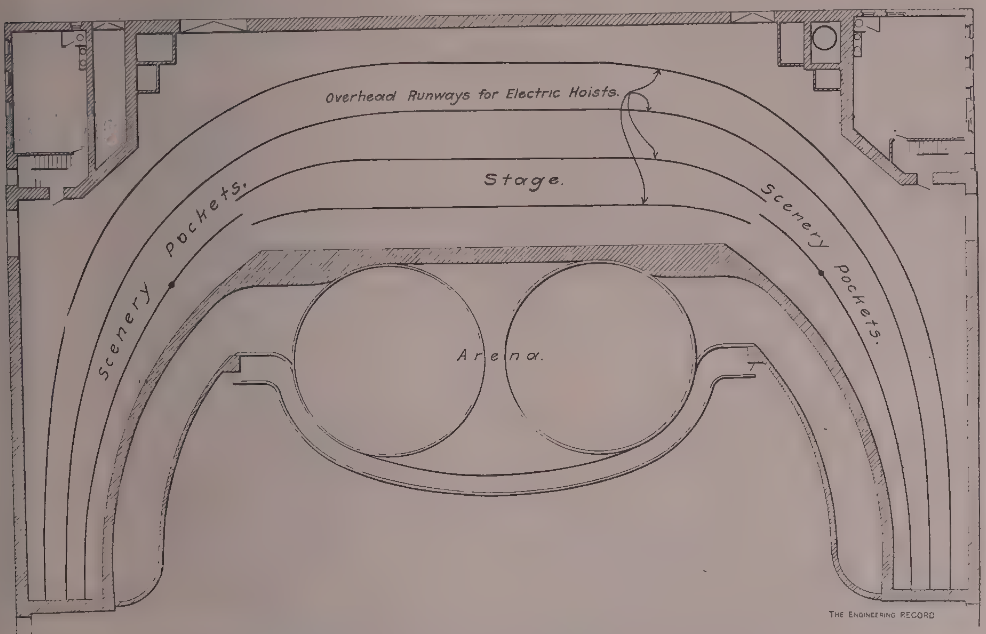
The control device for the arena platform is necessarily more simple, for only two hydraulic lifting cylinders are used and furthermore there is only one locking position, that being at the floor level. For the latter reason no indicating device is necessary, as the operator in the prompter's booth can easily observe the movement of the platform and throw in the locks when the platform has arrived at or is slightly above the floor level. An equalizing valve, of design similar to those for the stage, is used for constraining the two plungers to equal movement. In this case the water goes directly from the operating valve to the equalizing valve, which latter is controlled by hand for equalizing the movement of the two ends as required. In the case of this platform it is only necessary to bring the platform up slightly above the floor level, then throw out the locking devices and lower the platform down upon them, there being no intermediate locking positions or necessity of holding the platform at any position except at the top.

The stage platform locking devices are operated by motor controllers located at the operating board, so that they may be actuated when the markers on the annunciator show the platform to be in any locking position. An interesting arrangement of apparatus was incorporated for use in this connection for removing the weight

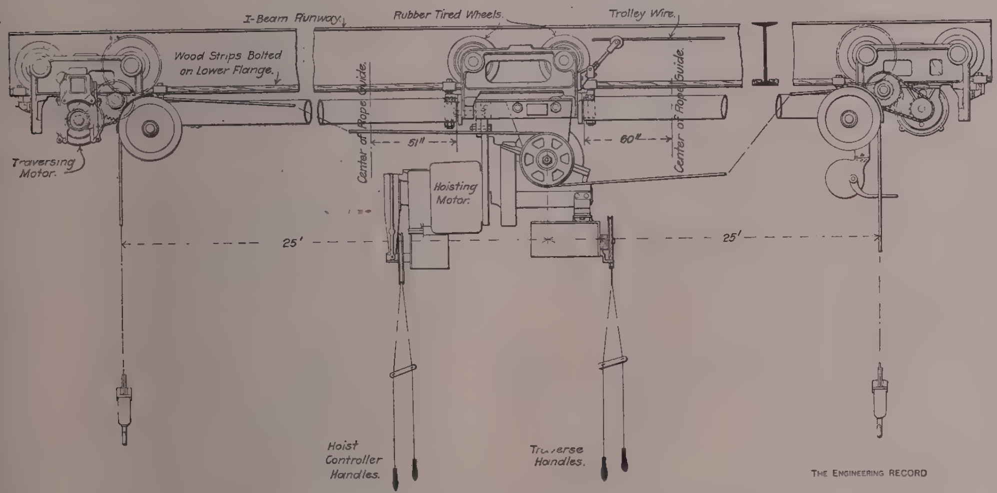


Details of Stage Lift, Operating Board and Position Indicator.

of the stage platform from the locking bars when it is desired to unlock the platform for elevating or lowering. For this purpose a special operating valve, located at the control board on the stage floor, works in connection with a small auxiliary accumulator having just sufficient capacity to raise the platform off the locking dogs and permit them to be withdrawn. When the latter are withdrawn the small accumulator operating valve is cut out and the stage lift operating valve thrown in for control through the equalizing valve system as above referred to.



Ceiling Plan above Stage showing Runways for Scenery Hoists.



Details of Electrically-operated Traveling Scenery Hoists.

Scenery Hoisting Apparatus.—One of the most interesting features of the mechanical equipment of the Hippodrome is the arrangement of the electrically-driven traveling hoists above the stage for handling the scenery and heavy stage settings. Owing to unusual size of the stage and its settings, the use of such apparatus has proved to be almost a necessity, while with this equipment it is possible to use large and elaborate scenery units which would otherwise prevent rapid changes in resettings of the stage. This hoisting equipment also enables unusual and striking moving scenic effects to be secured.

There are six of the crane runways crossing the stage in order to reach all portions from front to rear, and these lead off on either side into the scenery storage pockets at the rear of the boxes, as shown in the plan. The runways consist each of 12-in., 31½-lb. I-beams, the crane wheels running on the lower flanges of the beam which are covered with wooden strips to eliminate noise. The beams are carried underneath a special framework 75 ft. above the stage floor level. In passing around into the side pockets the runways curve around and the two forward tracks converge at each end into one, by means of a switch operated from the floor. This switch is interlocked to prevent the hoisting trolleys from running off an open switch point.

The traveling hoist apparatus consists of four special tandem traveling hoists and two single hoist sets, built by the Sprague Electric Co., New York. The four tandem hoisting sets consist each of two motor-driven traversing or trolley carriages of a standard type of this company, spaced 50 ft. apart in a separating frame, each trolley carriage being driven by a motor geared to the driving wheels by means of a silent chain. The wheels on these trolleys are fitted with heavy solid rubber tires vulcanized directly onto the tread of the wheels, only one pair of wheels on each trolley acting as drivers. Midway in the framework between the two motor-driven trolleys is placed a similar trolley carriage, without a traversing motor, from which is supended a worm-geared hoist with a series-wound motor direct-connected to the worm shaft; this intermediate trolley carriage carrying the hoist is spaced between and rigidly connected with the traversing trolley carriages by means of a framework of steel tubing in order to preserve the necessary distance between the hoisting hooks. The hoist has two drums, each of which winds two ropes; one rope from each drum is carried over the sheaves on one of the motor-driven trolleys, and the other two ropes over the sheaves of the opposite motor-driven trolley and down to the hooks. Each of these traversing trolleys has suspended below it two sheaves to carry the hoisting ropes, and the carriages are all fitted with guide rollers to take the side thrust on the I-beam runways.

The two traversing motors on the end trolley carriages are connected in parallel and operated by means of pendant cords from the floor through a cylinder-type reversible rheostatic controller on the plain trolley that carries the hoists. The hoisting controller is similar, although using no resistance, and it is also provided with pendant cords for operation from below. Both the hoisting and traversing controllers are mounted close together in the center of the set, so that the operating cords may be diverted to either end of the scene to enable the man operating the apparatus to see that everything is clear. Swiveling trolley-type current collectors are used on these hoists for taking current from the two hard-drawn copper trolley wires alongside each I-beam runway. These are supplied with 230-volt current for operation of the motors from the lighting and power switchboard in the basement.

Each set, as above described, has a maximum capacity of 1,000 lb. per hook, or a total of 2,000 lb. on both hooks. The hoisting speed without load is 54 ft. per minute, and with full load 27 ft. per minute. The hoists are designed for a maximum lift of 30 ft. Although the hoists operate at a height of 75 ft. above the stage level, sufficient rope is provided to enable the hooks to lift at the floor level, and the motors on the traversing trolleys are of sufficient size to give a movement on the runways of 100 ft. per minute, with the maximum load upon the hoist hooks.

The two single hoisting sets consist each of a worm-geared hoist, having a maximum lifting capacity of 2,000 lb., operating at a lifting speed of 54 ft. per minute without load and of 27 ft. per minute with full load. The height of the lift is 30 ft. and rope is supplied for lifting from the stage floor. This hoist is mounted on a motor-driven trolley carriage of design similar to those used for the traversing movement in the tandem hoist sets, and has a single traversing motor of sufficient size to give a traversing speed of 100 ft. per minute. The special noiseless features applied to the other hoists are incorporated in these single hoist sets.

The elimination of spur gearing from these equipments, the substitution of motors direct-connected to the worm shafts on the hoists and the use of the Morse silent chain in place of spur gearing on the trolley carriages, as well as also the use of vulcanized rubber-tired wheels on the trolleys, have resulted in apparatus which operates noiselessly.

Heating and Ventilating.—The heating and ventilating system installed at the Hippodrome follows the lines of general practice for theater structures in the use of an indirect system with the plenum-chamber system of distribution to the auditorium. The auditorium and stage together embrace about 3,500,000 cu. ft. of volume, which is ventilated by two fan systems in duplicate, each blowing either over steam coils for cold weather conditions or over refrigerating coils for summer service. Besides this, additional heating equipment is supplied in the form of radiators or large wall coils for direct radiation in the entrances, corridors, offices, dressing rooms, etc., and at the rear and sides of the stage. The ventilation is rendered positive by means of exhaust fans in the roof, which draw directly from the auditorium ceilings and through ventilating ducts from the balcony and gallery ceilings.

The fresh air blower system consists of duplicate fans at the sides of the stage in the basement, where they deliver from an intake duct at the rear of the building directly through the heater stacks into the plenum chamber beneath the auditorium floor. The intake duct on either side consists of a shaft with a cross-section of about 45 sq. ft. at the rear wall of the building where it rises to the inlet opening at a height of about 30 ft. above the sidewalk level. The fresh air fan for each shaft is located in an air-tight room at the bottom, each consisting of a full-housed fan with a 7-ft. wheel built by the American Blower Co.; each fan is driven normally at 175 r.p.m. by a 30-h.p. C & C electric motor for an air delivery of 50,000 cu. ft. per min. Thus two fans, one in either fan room, can supply the required amount of air for the full-house audience of 5,000 persons, namely, 100,000 cu. ft. per minute, or 20 cu. ft. per person per minute. The fan motors are, however, designed for an overload capacity of 50 per cent., so that 30 cu. ft. may be delivered to each person per minute.

The fresh air delivery passes from each fan room to the plenum chamber through stacks of heating coils, each stack consisting of six groups of coils which are operated on the Paul system with Powers automatic regulators set at varying temperatures for cutting out one group after another if the temperature of the auditorium air rises. The various radiators and heating coils in the stage and other parts of the auditorium are also controlled by Powers regulators. The cooling equipment consists of sets of brine coils arranged in the vertical fresh air intake shafts, over which coils water may be circulated, for increasing the action and regulating the humidity. The refrigerating plant consists of a 150-ton ammonia ice machine, with a plate-ice outfit, which was supplied by the De La Vergne Machine Co.; when in use the plant will be operated continuously, supplying the cooling coils during the afternoon and evening performances and the plate-ice equipment during the rest of the 24 hours, the latter being for storage purposes only to assist in keeping the brine temperature down and also to serve as an emergency cooling source in case of failure or accident to the machinery.

The fresh air enters the auditorium entirely from the floor openings beneath the seats and through a limited number of ducts leading up from the plenum chamber to the balcony floor and stage. The plenum chamber floor openings are continuous from aisle to aisle under every row of seats on the main floor of the auditorium; these openings, which are 5 in. wide, are formed by channel bars arranged in the floor framing to retain the floor concrete, and are covered by light gratings. This provides a total gross inlet area from the plenum chamber to the auditorium of over 2,000 sq. ft., giving a low velocity of inflow. Foul air is exhausted from the auditorium by two 6-ft. disc exhaust fans in the roof, so that a total exhaust capacity of 100,000 cu. ft. per minute also is provided.

A difficult factor in the ventilation problem for the building was introduced by the necessity of housing a large number of horses and wild animals in the basement for use in connection with the circus performances, but ventilation has been successfully secured for that section of the basement, as well as for the restaurant and café kitchens above, by the exhaust method. The incoming fresh air for these departments is heated or tempered, as required, by means of steam coil stacks in the inlet ducts, but the absence of the usual blower, in favor of the exhaust method, results in a perfectly satisfactory ventilation without transference of odors to the corridors or auditorium. The animal quarters and kitchens are ventilated by separate fans in the basement, each an American Blower Co. fan with a 7-ft. wheel driven by a 25-h.p. C & C motor. The discharge from the kitchen fan is carried up alongside the chimney at the rear of the building to a height about 100 ft. above street level, while the discharge from the animal quarters is carried up at the rear to a height of about 80 ft.

Steam for the heating supply is furnished by two 300-h.p. Stirling water-tube boilers located in a sub-basement at the rear. These generate steam at 125 lb. pressure for the direct operation of the fire and house pumps, as well as the high-pressure pump for the stage plungers. The steam for the heating service is supplied through reducing valves for a delivery pressure of from atmosphere to about 3 lb. The auxiliary equipment consists of two boiler feed pumps, a house pump and two fire pumps, all built by the Deane Steam Pump Co. The entire heating and ventilating equipment was designed and installed by the L. H. Prentice Co., New York.

An Important Problem in Railway Curves.

By Antonio Llano.

The problem given below is of constant occurrence in railroad work, especially in the location of street railway curves. The solution here presented seems to the writer much simpler than any of the many others he has seen.

Given two indefinite tangents $B X_1$ and $B X_2$ (see accompanying figure), and their angle of intersection Δ, it is desired to connect them by a circular curve at a given distance a from a given point Q. Required the radius r of the curve.

Let Q be located by the perpendiculars $Q H_1 = m_1$ and $Q H_2 = m_2$, which may be either measured or calculated from the data. Then,

$$r = a + \frac{(m_1 - a) + (m_2 - a) + 2\sqrt{(m_1 - a)\ (m_2 - a)}\ \cos \tfrac{1}{2}\Delta}{2\ \sin^2 \tfrac{1}{2}\Delta} \quad (1)$$

This formula is derived as follows: The right-angled triangles $O Q D_1$ and $O Q D_2$ give,

$$r - m_1 = (r - a) \cos \theta_1,\ r - m_2 = (r - a) \cos \theta_2.$$

Solving each of these equations for r, the results may be reduced to the following forms:

$$r = a + \frac{m_1 - a}{1 - \cos \theta_1} = a + \frac{m_1 - a}{2 \sin^2 \tfrac{1}{2}\theta_1} \quad (2)$$

$$r = a + \frac{m_2 - a}{1 - \cos \theta_2} = a + \frac{m_2 - a}{2 \sin^2 \tfrac{1}{2}\theta_2}$$

Equating the two values of r, and transforming,

$$\frac{\sin \tfrac{1}{2}\theta_2}{\sin \tfrac{1}{2}\theta_1} = \sqrt{\frac{m_2 - a}{m_1 - a}}$$

Writing $\Delta - \theta_1$ for θ_2, expanding $\sin \tfrac{1}{2} (\Delta - \theta_1)$, and dividing both terms of the resulting fraction by $\sin \tfrac{1}{2}\theta_1$,

$$\sin \tfrac{1}{2}\Delta \cot \tfrac{1}{2}\theta_1 - \cos \tfrac{1}{2}\Delta = \sqrt{\frac{m_2 - a}{m_1 - a}};$$

whence

$$\cot \tfrac{1}{2}\theta_1 = \frac{\cos \tfrac{1}{2}\Delta + \sqrt{\dfrac{m_2 - a}{m_1 - a}}}{\sin \tfrac{1}{2}\Delta} \quad (3).$$

From this we obtain, since $1 \div \sin^2 = 1 + \cot^2$,

$$\frac{1}{\sin^2 \tfrac{1}{2}\theta_1} = 1 + \left(\frac{\cos \tfrac{1}{2}\Delta + \sqrt{\dfrac{m_2 - a}{m_1 - a}}}{\sin \tfrac{1}{2}\Delta} \right)$$

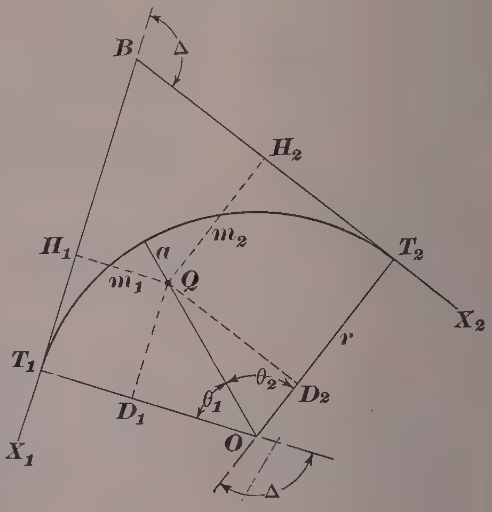
$$= \frac{1 + 2 \sqrt{\dfrac{m_2 - a}{m_1 - a}} \cos \tfrac{1}{2}\Delta + \dfrac{m_2 - a}{m_1 - a}}{\sin^2 \tfrac{1}{2}\Delta}.$$

The substitution of this value in the final member of equation (2) gives formula (2).

Formula (3) may be used to determine $\tfrac{1}{2}\theta_1$, and then r may be found from equation (2). In general, however, it is preferable to determine r directly from formula (1).

If, as often happens, point Q is located by the distance $B H$ ($= x$, say) and the offset m_1, the value of m_2 is determined by the formula

$$m_2 = x_1 \sin \Delta + m_1 \cos \Delta.$$



When Q is outside the curve, the preceding formulas apply, but the sign of a should be changed. By making $a = 0$, the same formulas serve to solve the problem of connecting two tangents by a curve that shall pass through a given point.

FREIGHT CABLEWAYS are used at Manaos, on the Amazon River, a thousand miles from Para. The vessels discharge at floating landing stages some distance from the shore. Adjoining these stages is a 300x60-ft. steel pontoon carrying the head towers of three 2-ton Lidgerwood cableways of 550 ft. span. The tail towers are located between the warehouses on shore. The cableways are of the double-track type. The shore ends of the track cables are not made fast, but, passing over sheave wheels at the apex of the towers, are fastened to vertical counter weights of 10 tons sliding in guides on the far side of the tower. Thus the strain on the track cables can never be greater than the initial strain due to the counter weights. Both the endless and hoisting lines operating the to and fro motion of the carriage and the hoisting fall are operated by means of a special double-drum winch direct geared to a 75-hp., 250-volt, series-wound, direct-current motor, located in the base of the "head" tower on the float.

Base Line Measurements for the Pennsylvania R. R. Tunnels at New York.

In laying out the base lines for the location of the tunnels of the Pennsylvania R. R. under the East and North Rivers at New York the methods followed were unusual because much of the work had to be done on streets and sidewalks where no stakes could be driven. The apparatus used on these measurements, according to a paper by Mr. A. H. Bennett in the "Michigan Technic," consisted of a 100-ft. steel tape graduated to hundredths, an anchor post, a tension wheel and 12-lb. brass weight, several movable stations, four standards for supporting the tape, and four thermometers. The anchor post was an upright of wood about 4 ft. high, fitted to a flat base. A block, which could be pushed up and down the post to any desired position and secured by tightening a nut, carried a cord and hook for attaching an end of the tape. Cords with tent rope adjustment attached to top and bottom were thrown over a spike, when it was possible to drive one; otherwise they were held by a man standing on them. The tension apparatus was a ball-bearing bicycle wheel attached to a heavy gas-pipe frame. The rim was supplied with three grooves, which carried two cords to support the weight and one cord for attaching the tape, the tape cord passing between the two weight cords. The frame was susceptible of various adjustments. The weight of the frame and wheel was about 150 lb.; it might be made of smaller weight and still leave a comfortable margin to prevent sliding on a stone sidewalk or asphalt pavement. The movable station was soon nick-named the "Spider." It was an iron tripod, carrying a center shaft with a brass cap, rounded off to a radius of 15 in. The legs were screw-threaded, although the position of the spider could be so chosen as to make adjustment seldom necessary. The weight was 75 lb.

The monuments were generally placed under the sidewalks at street corners, near the curb. They were built by embedding a brass plug in a block of concrete, set below the sidewalk level, the whole being covered with a cast-iron box, whose cover lay flush with the walk and was fastened down by a screw bolt.

In carrying on the work spiders were set up at intervals of about 99.5 ft., from one monument toward the other. The tape was then set up over the first space, with the anchor post ahead and the tension wheel behind. The distance between the monument and the cross mark on the first spider was read; then the tape was moved forward and the distance between the first and second spiders read, and so on until the monument at the other end of the line was reached. When any spider had been read by the head and rear chainmen and the tape moved up the spider thus left could be taken up and moved forward, ready to be used again. In this way no more than three spiders were essential. Four spiders were used, however, two being read, one remaining 100 ft. back and one being carried forward to the next station. As the work was done at night, there was no danger of the one left behind being disturbed.

Previous to the actual measurement a party went out with transit and tape and marked off 99.5-ft. spaces in line, scratching a mark on the sidewalk or paving stones. This party was followed by levelers, who took the elevations of the points.

The party consisted of two head chainmen, two rear chainmen, a transit man, a thermometer man and a recorder. The first thing was to open the monument, set up the transit near it approximately at right angles to the line, and set out two or three spiders over the points previously located. The head chainmen set up the anchor post so that two or three-tenths of the last foot on the tape would extend beyond the first spider. The rear chainmen set up the tension wheel so as to bring the rear end of the tape vertically over the monument. The thermometer man set up his standards at each 20-ft. division and placed the tape in the hooks, which hung by cords. A back-sight was given at one end of the tape, and the hooks were given their elevations by a man sighting from the other end, so that the tape was supported at six points in the same straight, but not necessarily horizontal, line. The back-sight was a small, white-painted board, made to set upon the spider so that its lower edge was upon the tape. Light was thrown upon it from an acetylene bicycle lamp, and the thermometer man had an ordinary oil lantern fitted up with a white-painted paddle projecting from it and a shield to screen the direct light from the observer. The thermometer man had merely to hold the lantern so as to bring the upper edge of the paddle up to the tape from beneath, and the observer thus had a ready means of accurately lining up the tape. The height of the spider and the distance from the monument up to the tape were taken by a short graduated rod, so that the slope of the tape could be determined from the level notes. The transit having been leveled, a setting was made upon the monument, the telescope was then raised to the tape, and the transit man was ready to take readings on the rear end of the tape. All being ready, the rear man called out, and both ends of the tape were read simultaneously, thousandths being estimated. In this manner five to ten readings were taken, and after each reading the tension wheel was given a slight impetus, alternately forward and back, in order to disturb the tape and make the next reading an independent observation, as well as to counteract to an extent the effect of friction in the apparatus. While this was being done the thermometer man had an opportunity to read each thermometer at least once, and sometimes oftener. The tape was then carried forward to the next space.

The primary reason for working at night was because the travel in the streets during the day made measurement impossible, but another decided advantage was also gained in that the temperature of the tape was more nearly the temperature recorded by the thermometers, whereas in the daytime the direct action of the sun and the reflected and radiated heat from the pavements and walks would make the temperature of the tape a very uncertain quantity.

Rapid progress was made along the smooth walks. Spiders were kept set ahead, and, these being of the same height, no adjustments of anchor post or tension wheel were necessary except to shift them into line, which was very readily accomplished. An average speed of 1,000 to 1,200 ft. per hour was made.

When the base line was in the city the triangulation stations were located on the roofs of nearby buildings. The short lines from the monuments to these stations were measured in the same way as the long lines, after a preliminary step which was done in the daytime. One triangulation station, for example, was on the parapet wall of a five-story factory building, about 250 ft. from the monument, and on the opposite side of the street. A transit was set up over the monument, a back-sight taken on the triangulation station, and then a point was given to the man on the roof where the line ran off the wall. Two points were also given on the sidewalk close to the building, so that a portion of the line could be drawn. The transit was then set up at a point opposite where the line ran into the building. The man on the roof marked off a measured distance on a piece of edging, such that when the strip was placed in line, with one mark over the triangulation station, the other mark would clear the wall. This mark was dropped down to the sidewalk by the transit, and it is to the point thus located that the line was measured by the apparatus as described.

All the different tapes used in measuring base were compared with a standard tape whose absolute length was known, for a certain temperature and for a tension of 10 lb., the tape being supported its entire length. It was designed to test the tapes under the conditions of actual use in order to eliminate such corrections as possible. A bench somewhat more than 100 ft. long was obtained in a room where the temperature was not subject to sudden fluctuations. Under the ends of the bench were fastened two zinc strips on cleats, with cross lines which were nearly 100 ft. apart. All the tapes were unreeled and hung up by the two ends, that they might acquire the temperature of the room, which was recorded throughout the test. The standard tape was first laid upon the bench and supported throughout its length, and a pull of 10 lb. applied. Readings on the two zinc marks were made at the same time, the thousandths being read with the aid of a reading glass and a small scale graduated to thousandths. This done, the tape to be compared was placed in position, supported only every 20 ft., the 12-lb. weight applied by means of the tension wheel, and readings were then taken as on the standard tape. The absolute distance between the marks was obtained from the standard tape. The difference between the two end readings on the base line tape gives the distance as measured in the field. The difference between this and the true distance is a correction, which must be applied to every 100-ft. distance measured by that tape, and which includes corrections for standardization, sag and tension. This leaves only two corrections remaining; namely, those for temperature and for slope. In addition, however, the first and last foot of the tape were calibrated by comparison with a standard Brown & Sharpe 1-ft. steel scale graduated to thousandths, and a table was made of the true readings for each hundredth. In the reductions the corrections above described were not applied to each 100-ft. space, but were entered in columns, and these columns were algebraically added and the resulting correction applied in one operation.

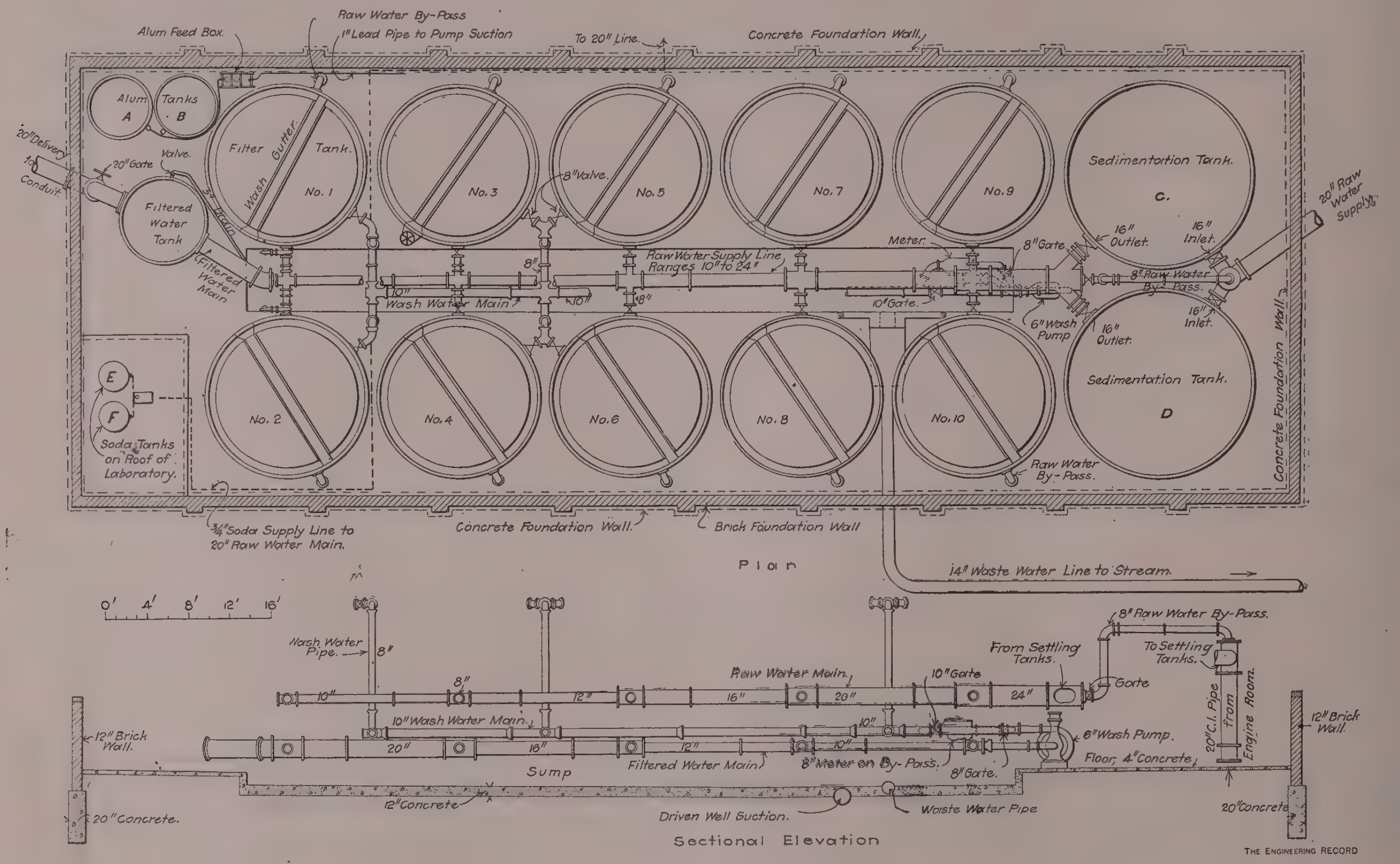
For the East River location there are about 38,100 ft. of base line, in pieces 4,000 to 6,000 ft. long. The total distance measured was 164,000 ft. The best determination that was made of a single line was that of a line 4,800 ft. long. Five measurements were made upon it, with a resulting probable error of 1 in 2,400,000. The line with the greatest probable error had 1 in 250,000, and the average was about 1 in 580,000. This includes all of the measurements. Some of them were made in the daytime, and those had a much greater probable error than the night measurements. The cost of the apparatus might be itemized as follows: 4 spiders and tension apparatus, $111.90; 1 12-lb. brass weight, $11; 1 tape, $10.50; 6 thermometers, $1.20; 1 anchor post and 4 intermediate standards, $3.75; 2 oil lanterns, $1.20; 5 gas lanterns, $10; calcium carbide, $4, and 2 hand axes, $1; total, $154.55.

The cost of the work, counting in one-half the cost of the apparatus, was $6.16 per 1,000 ft. measured. This figure, however, includes some items of expense for materials besides those given above, such as replacing stolen brass; and the labor item is probably higher than would be necessary in a party organized for such work.

The Salt Industry in the United States produced about 22,030,000 bbl. of 280 lb. each in 1904, valued at $6,021,000. The most important feature of the year was a notable increase in the production of rock salt, which is cheaply mixed in Southern Louisiana. Two-thirds of the total production was from New York and Michigan.

Mechanical Filters of the Brooklyn, N. Y., Water-Works.

Two mechanical filter plants, built to purify a small portion of the water supply of the Borough of Brooklyn of New York City, have given uniformly good results since they were completed nearly two years ago. The water supply of the borough is partly from wells and partly from surface streams. The wells have been driven in groups along a conduit about 15 miles long which leads to the city. Pumping stations are installed at the various groups of wells, their pumps drawing directly from the wells and discharging into the conduit or into cast-iron mains paralleling it. At two of these stations small ponds fed by springs and surface streams were formerly used as sources of supply in addition to the supply furnished by the wells. These two ponds became more or less polluted and were thrown out of service several years ago, but as the demand for water increased their supply was required and filter plants were built to purify the water from them.



THE ENGINEERING RECORD

General Details of Filter Plant at Baisley's Pond, Brooklyn, N. Y.

One filter plant is near the pumping station at Baisley's Pond and has a capacity of 5,000,000 gal. per 24 hr. The other plant is at the Springfield pumping station and has a capacity of 3,000,000 gal. per 24 hr. The plants are quite similar in design and are operated in practically the same manner. Sulphate of alumina is used as a coagulant in the operation of both, and as the alkalinity of the raw water is frequently very low, soda ash is also applied at times to produce the proper flocculence of the alum.

The pond at the Baisley's station is about 1,100 ft. from the station building and at sufficient elevation above it that a gravity flow takes place from an intake in the pond through a 20-in. main to a 10-in. Lawrence centrifugal pump in the station. This pump elevates the raw water through a 20-in. main to the filter plant, which is in a frame building adjoining the brick pumping station. The filter plant consists of 2 sedimentation tanks and 10 filter tanks in 2 rows, 1 sedimentation tank and 5 filter tanks in a row, as shown in the accompanying plan, and all on brick and concrete piers.

The tanks are of circular wood-stave construction, bound by iron bands and open at the top. The sedimentation tanks are 18 ft. in diameter and 21.5 ft. high in the clear. The raw-water inlet to each of these tanks from the 20-in. mains from the pump enters near the bottom, a series of baffles directing and distributing the flow so as to utilize the full capacity of the tank. The water remains in the tanks about 30 min., when both sedimentation tanks are in service and the plant is operating under normal conditions. It is drawn from them by pipes near the top and flows by gravity through a supply main laid between the two rows of tanks and connected to the lower part of each filter tank. The filter tanks are 14.5 ft. in diameter and 22.5 ft. high in the clear. The lower 14 ft. of each of them affords an additional sedimentation capacity, the filter beds being in the upper part of the tanks and separated from the lower part by a tight timber platform covered by a thin reinforced-concrete floor. The portion of each tank below the filter-bed floor is divided in two parts by a horizontal partition and the two divisions connected by an opening in the partition. The flow is from below upward and is directed by baffles, the water finally passing through a pipe outside the tank to the filter bed above.

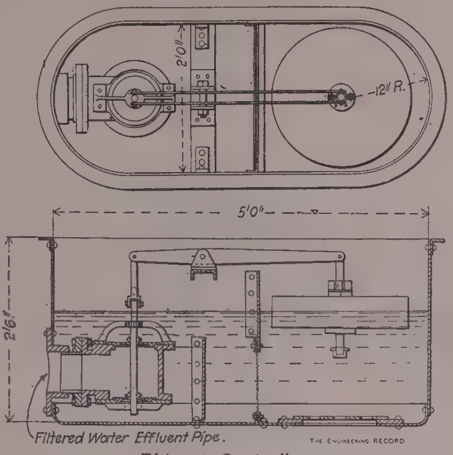
The filter bed of each tank has a total depth of 3 ft. 9 in., including the filtering material, underdrainage system and the pipes for the compressed air and water used in washing the bed. The underdrainage system consists of a manifold varying from 4 to 6 in. in diameter, laid diametrically in the bottom of the bed, with 2½-in. wrought-iron pipes on 12-in. centers connected to it at right angles. These 2½-in. connections extend nearly to the circumference of the tank and are reduced in size at different points until they are 1 in. in diameter at the ends. This gridiron system of pipes is imbedded in a layer of concrete directly over the reinforced-concrete floor, and brass strainers which extend about 4 in. above the concrete are screwed into the smaller pipes connected with the manifold. Each of these strainers consists of a short vertical irregular cylinder, closed at the top, with five horizontal, finely-slotted, ½-in. brass pipes, 5 in. long, screwed into it. These small brass pipes are closed at the outer end and radiate from the central cylinder, with equi-distant angles between them. The strainers are placed to cover the bottom of the bed uniformly and are surrounded with a 4-in. layer of gravel which has an effective size of 6 mm., the horizontal radiating arms being at the center of the layer. A 4⅞-in. layer of gravel with an effective size of 3.6 mm. is laid over the coarse gravel and over it is 30 in. of sand which has a uniformity coefficient of 1.74, an effective size of 0.43 mm., and contains 8 per cent. of material finer than 0.24 mm.

The pipes conveying the compressed air are in the upper layer of gravel, a vertical air line connecting the air distribution system of each tank with a main air-supply pipe from a compressor in the station. The air-distribution system consists of a horizontal main directly over the manifold of the underdrains, with slotted ½-in. brass pipes, on 6-in. centers, screwed into it at right angles on either side, the slotted pipes extending nearly to the sides of the tank. The slotting of the brass pipes of the collectors and air system was designed after a large number of experiments had been made to determine the best sizes and arrangement of the slots. The collectors are so distributed and the slots in their small pipes so placed that practically an equal resistance is secured in all parts of the sand bed, while it has also been possible to obtain a very even distribution of the compressed air.

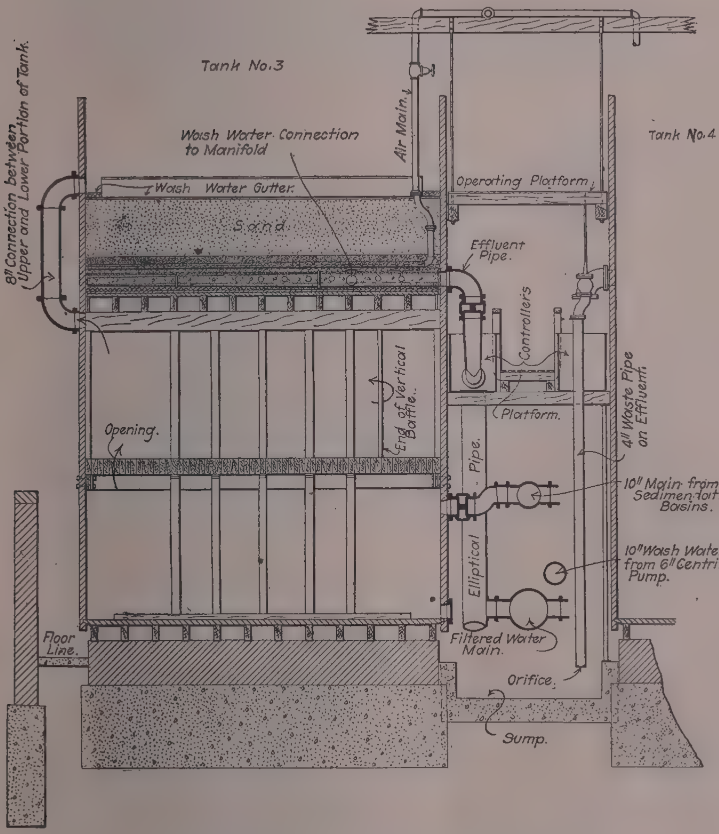
The water from the portion of the tank below the filter enters the filter bed through open troughs which distribute its flow and prevent any scouring of the sand. One of these is a circular trough, 8 in. high and 8 in. wide, built against the side of the tank, with its bottom just above the sand surface. A straight trough of the same cross-section with one of its ends at the raw-water inlet, connects the circular trough diametrically. The water passes down through the filtering material into the collecting system and manifold and then through an automatic controller on the effluent pipe to a clear-water tank.

The head on the filters is equal to the height of water in the sedimentation tanks less the loss by friction in passing from those tanks to the different filters. The rate of filtering is governed by the automatic controller and the loss of head in the filter beds is indicated by a Dibble gauge on a standard beside each tank, the float actuating the gauge pointer being in a vertical pipe connected with the effluent pipe. The zero on the gauge dial is set so the pointer rests on it when the bed is clean and covered with the normal depth of water. As the bed becomes clogged and the height of water in the float pipe is lowered the difference between that level and the level of water in the tank is indicated on the dial by the pointer.

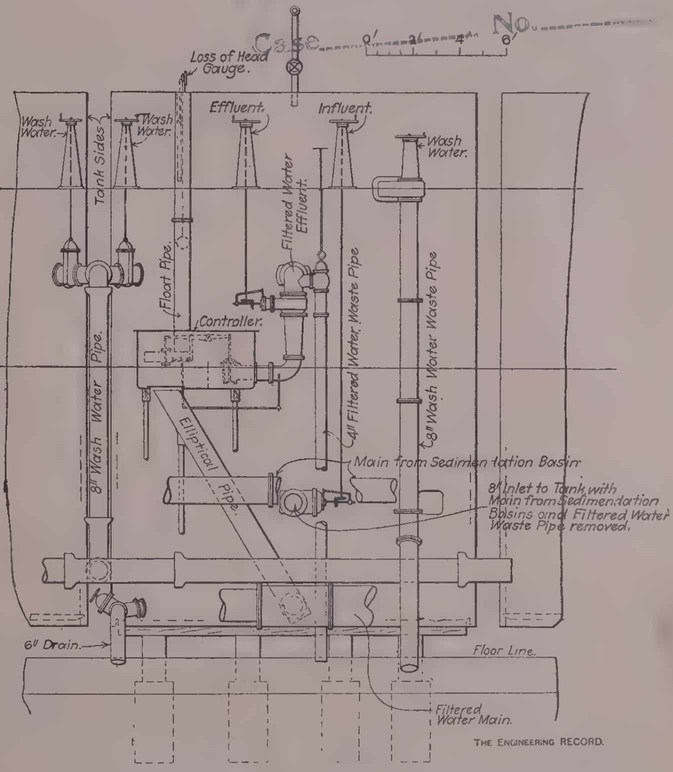
The effluent controller of each filter tank is a small oval sheet-steel tank into which the effluent pipe discharges, the arrangement of the interior of which is shown in one of the accompanying illustrations. The rate of flow in the effluent pipe is governed by a vertical piston valve on the end of that pipe in the controller tank. The stem of this valve is attached to a lever arm and to the other end of the lever arm is attached the vertical stem of a float which rests on the water in the tank. Transverse baffles prevent the disturbances caused by the flow from the valve affecting the float and the discharge from the controller is through a horizontal standard orifice in the bottom of the float end of the tank. This orifice has a free discharge into the air, the elliptical pipe into which the water flows from it being separated about 1 in. from the bottom of the tank. The rate at which water is passing through the filter is determined by the head on the standard orifice and can be changed by varying the height at which the controller float is set. The elliptical pipes from the controllers all connect with a filtered-water main which leads to a small clear-water tank in the end of the building, the water passing from this tank to the conduit leading to the city.



Effluent Controller.


Tank No.3
Tank No.4
8" Connection between Upper and Lower Portion of Tank.
Wash Water Connection to Manifold
Air Main.
Operating Platform
Wash Water Gutter.
Sand.
Effluent Pipe.
Controllers
End of Vertical Baffle.
Opening.
Platform.
4" Waste Pipe on Effluent.
Elliptical Pipe.
10" Main from Sedimentation Basins.
10" Wash Water Main from 6" Centrifugal Pump.
Floor Line.
Filtered Water Main.
Orifice.
Sump.

Half Cross Section of Filter Unit at Baisley's Pond.



Piping Arrangement of Filter Unit at Baisley's Pond.

The alum used as a coagulant is made into solution in two tanks in the filter building and introduced into the suction of the pump in the station through a 1-in. lead pipe leading from the tanks. The flow through this alum feed pipe is regulated by floats in a small feed box near the mixing tanks, as it has been found that the regularity of the flow in a pipe directly from the mixing tanks to the point of application could not be relied upon. One of the floats in the feed box is on a valve on the inlet pipe from the alum tanks and governs the amount of alum solution admitted to the box, the strength of the solution being determined in mixing from the depth of water in the mixing tanks and the quantity of alum used. This float is in a chamber made by a transverse partition and takes up about half of the box. This partition has a right-angle Z-shape, with an upper and lower vertical portion and a horizontal connection between them in which a standard orifice governed by a valve with an indicating disk is placed. A float actuating the valve on the pipe leading to the pump is in the remaining portion of the box, the level of the liquid being low enough in the second chamber to give the horizontal orifice in the partition a free discharge. A stream of filtered water is kept running in the outlet valve chamber to maintain a constant flow in the alum-feed pipe, but even with this precaution the pipe becomes clogged and arrangements are made for flushing it. The mixing tanks are provided with floats and measuring gauges by which the rate of alum feed, as indicated by the orifice, is checked.

The soda is mixed in two tanks over an office and laboratory room in the same end of the building as the alum tanks. A small steam line from the station furnishes the heat required in making the solution and the mixing is assisted by compressed air from a small compressor in the filter building, the solution in the alum tanks being agitated by air from the same source. The soda solution is applied to the raw water in the 20-in. main leading down from the pond.

The filters are washed by reversing the flow through them and agitating the sand bed with compressed air. The head lost in the sand bed is allowed to reach from 2.5 to 8 ft., depending on the amount of sediment in the raw water, before a filter is washed. The valve standards are all on the same operating platform. The valve on the influent connection is first closed and the water above the bed drawn down until it is about 3 in. deep over the sand, when the effluent valve is closed and compressed air under about 5 lb. pressure at the tanks turned on. The air is allowed to pass through the sand for 3 min. before the wash water is admitted, the continued operation of the plant having deter-

FRANK A. RANDA
Case No.

mined that this amount of agitation secures the best results on the average. The valve on the wash water supply pipe is opened after the required amount of air has been applied. This wash-water supply pipe in each tank is connected with the manifold of the collecting system in the bottom of the tank and the wash water enters through the strainers. The wash water is supplied through a 10-in. main, laid the length of the building between the rows of tanks, by a 6-in. Lawrence centrifugal pump in the filter building, which has its suction connected to the filtered water main.

The air supply is continued after the wash water is turned on until the water rising slowly above the sand nearly reaches the tops of the distributing troughs, when the air is shut off to prevent the washing away of fine sand. The wash-water flow is continued with the gate on a waste pipe connected with the distributing troughs open until the water coming through the sand is clear in places, when it is shut off and the waste gate closed. The raw water is then slowly admitted again, and if it is unusually bad a 4-in. by-pass on the effluent pipe is opened for a few minutes before the filter is put in service again.

A meter is placed on the discharge of the wash-water pump to measure the quantity of wash water used, and it can be checked by the operation of the pump which has been calibrated under different conditions. The waste water, if there is any, is measured by a standard orifice on the effluent by-pass. The wash and waste water is discharged into a concrete sump built the length of the building between the tanks and connected with a sewer. Drain-outs are provided at the bottom of all the tanks which also discharge in this sump, and the concrete floor of the building is sloped toward it from both sides.

The general design of the Springfield plant is practically the same as that of the plant at Baisley's and both plants are operated in as nearly the same manner as a few differences in local conditions will permit. The pond at the Springfield plant is connected by a 48-in. pipe from the intake to an open brick suction well built in connection with a brick pumping-station building. The raw water is drawn from this well and elevated to the filter building, which is adjacent to the pump house, by an 8-in. Lawrence centrifugal pump. The filter plant has 2 sedimentation and 6 filter tanks placed the same as and of corresponding size to those in the larger plant, with the same arrangement of piping connections throughout.

The operation of both plants is under the immediate directions of a chemist and bacteriologist, who has a completely-equipped laboratory at the plant at Baisley's Pond. Daily examinations are made of the chemical quality and the number of bacteria in the raw and filtered water and the results of these examinations and the entire mechanical operation of both plants are carefully recorded.

Three filter attendants are required to operate each plant, one for each 8-hr. shift, and an extra mechanic is employed who divides his time between the two pumping stations and filter plants as the occasion demands. The average cost of filtering 1,000,000 gal. of water during 6 months from July to Dec., 1904, at the plant at Baisley's was as follows: Chemicals and supplies, $1.72; labor, $2.53; interest and sinking fund, $2.21; total, $6.46. The corresponding costs at the Springfield plant during the same time were: Chemicals and supplies, $1.67; labor, $4.35; interest and sinking fund, $2.89; total, $8.91. The increased cost for labor at the latter plant is due to the fact that the same amount of labor is required in the operation of both plants, although one has a capacity of 5,000,000 and the other of 3.000,000 gal. per 24 hr.

Average Daily Results of Tests at Baisley's and Springfield Filter Plants.

	Springfield. Corrected averages of results on six-tank basis for three two-week periods.	Baisley's. Averages of results of three two-week periods.
Water pumped, corrected, 20-in. meter, gal.	3,114,887	5,159,345
Total filtered as indicated by controllers, gal.	3,052,226	5,104,144
Net filtered as indicated by Weir beyond the clear-water tank, gal.	2,913,732	4,841,680
Wash water, gal.	121,131	262,467
Waste water, gal.	5,009	7,713
Wash waste water, per cent. of total filtered.	4.13	5.29
Wash waste water, per cent. of total pumped	4.04	5.23
Number of tanks in operation	(*b*)	10
Number of washings per day	(*b*)	25.5
Average rate of filtration in million gallons per acre (*a*)	123.55	126.4
Per cent. of variation from mean rate of filtration (*a*)	1.52	.55
Alum soda used lb. (*a*)	665.55	1,045
Alum soda used, gr. per gal. (*a*)	1.581	1.42

(*a*) Not corrected on the 6-tank basis.

(*b*) For 14 out of the 42 days covered by the Springfield tests only 5 tanks were in operation. The figures for the Springfield plant are the corrected averages of results on a 6-tank basis for three 2-week periods. The figures for the Baisley's plant give the averages of results of three 2-week periods.

Summary of Analyses Made in Official Tests of Mechanical Filter Plants at Baisley's and Springfield Ponds.

	Average results of three two-week tests.		Requirements of Specifications.
	Baisley's.	Springfield.	
Physical.			
Average turbidity of raw water	14.9	6.3	
Average turbidity of filtered water	.2	.41	
Percentage reduction	98.7	94.0	
Average color of raw water	31.0	17.0	
Average color of filtered water	3.0	1.0	
Percentage reduction	90.3	94.0	
Prevailing odor of raw water	2V	2V	
Prevailing odor of filtered water	0	0	
Chemical.			
Average albuminoid ammonia raw water	.173	.109	
Average albuminoid ammonia, filtered water	.045	.042	
Percentage reduction	74.0	61.5	
Average free ammonia, raw water	.091	.067	
Average free ammonia, filtered water	.067	.056	
Percentage reduction	26.4	16.3	
Average iron, raw water	1.14	.39	
Average iron, filtered water	.03	.09	Less than in raw water.
Percentage reduction	97.4	77.0	
Average alkalinity, raw water	24.2	12.1	
Average alkalinity, filtered water	17.9	10.7	More than 0, but less than raw water
Percentage reduction	26.0	11.5	
Miscroscopical.			
Number of samples examined microscopically	38	35	
Average number microscopic organisms, raw water	2471	160	
Average number microscopic organisms, filtered water	0	3	
Percentage reduction		98.1	
Number of samples which had efficiency below 97 per cent.	2	5	
Percentage of samples which had efficiency below 97 per cent.	2.8	14.3	Less than 5 per cent.
Bacteriological.			
A.—*When numbers of bacteria in raw water were more than 2,500 per c.c.*			
Number of samples of raw water collected	25	62	
Average number of bacteria per c.c. in raw water	4044	11251	
Number of samples of filtered water collected from main discharge pipe (entire plant)	25	62	
Average number of bacteria per c.c. in filtered water (entire plant)	62	114	
Percentage reduction (entire plant)	98.5	98.6	Above 97 per cent.
Number of samples of filtered water (entire plant), which gave percentage reduction below 90 per cent.	0	0	
Per cent. of samples of filtered water (entire plant), which gave percentage of bacteria below 90 per cent.	0	0	Less than 5 per cent.
Number of samples of individual tank effluents collected	0	57	
Number of tank effluents which gave percentage reduction of bacteria below 90 per cent.	0	1	
Per cent. of samples from individual tank effluents which gave percentage reduction below 90 per cent.	0	1.8	Less than 10 per cent.
per c.c.			
B.—*When numbers of bacteria in raw water were less than 2,500 per c.c.*	86	84	
Average number of bacteria per c.c. in raw water	1089	1133	
Number of samples of filtered water collected from main discharge pipe (entire plant)	86	84	
Average number of bacteria per c.c. in filtered water (entire plant)	23	22	Less than 75.
Percentage reduction (entire plant)	97.9	98.1	
Number of samples of filtered water (entire plant) which contained more than 250 per c.c.	1	0	
Percent. of samples of filtered water (entire plant) which contained more than 250 per c.c.	0	0	Less than 5 per cent.
Number of samples of individual tank effluents collected	110	146	
Number of individual tank effluents which contained more than 250 bacteria per c.c	0	1	
Per cent. of samples from individual tank effluent which contained more than 250 bacteria per c.c	0	0.7	Less than 10 per cent.

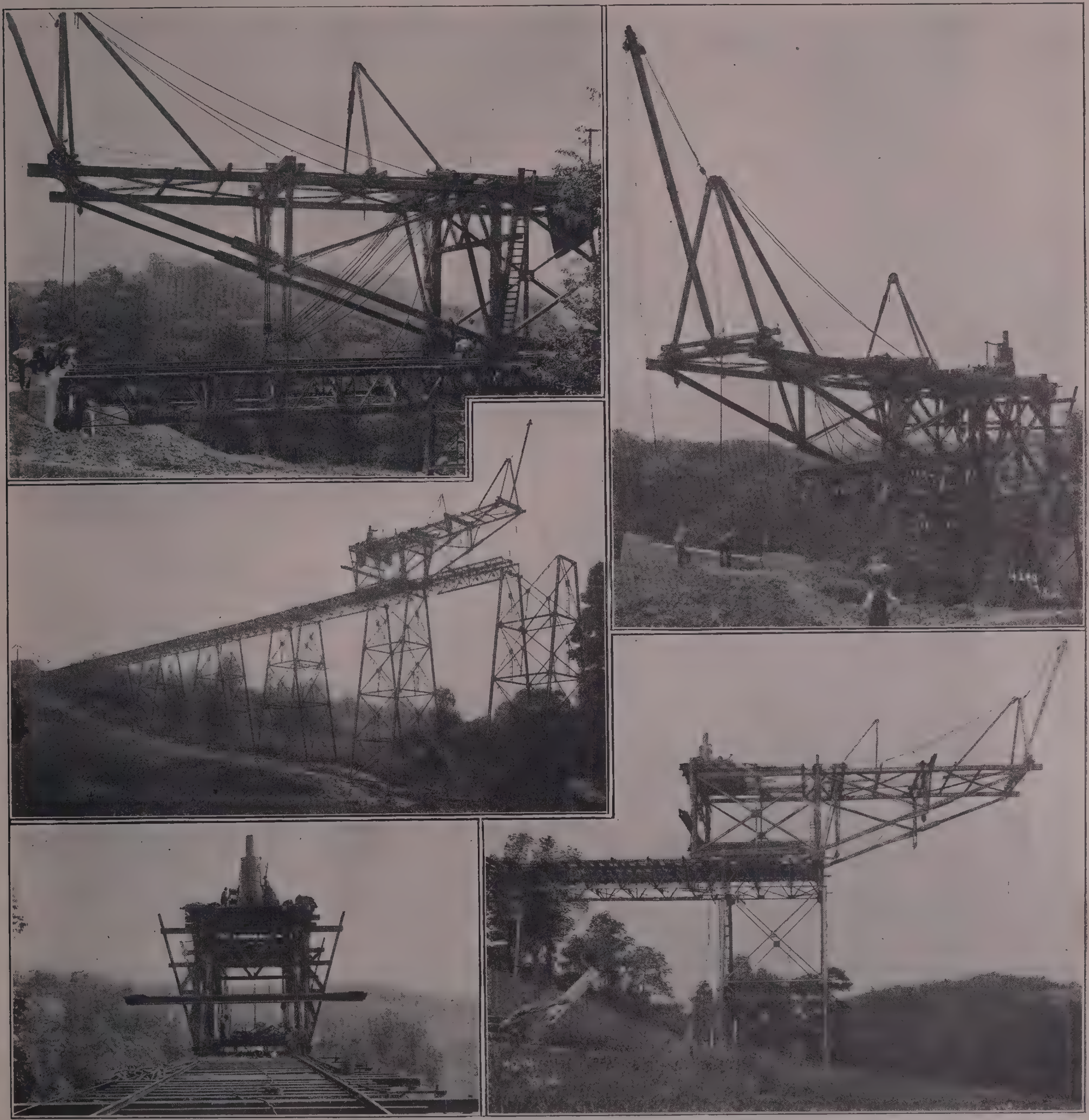
A number of tests extending over considerable periods were run on the plants shortly after they were completed to determine their efficiencies and the cost of operation. The averages of the results of a number of these tests, which are typical of all those run, are given in the accompanying tables. The total water pumped was measured by a meter in the suction of the centrifugal pump in the station in each case. The total quantity filtered was measured by the controllers on the filter tanks, while the net quantity filtered and sent to the conduit was measured by a weir beyond the small clear-water tank at each plant. The wash and waste water were measured by methods already described. All the tanks were in operation at the Springfield plant except on 14 days of the period covered by the tests, while the 10 tanks at Baisley's were in operation during all this time. The variation from the mean rate of filtration at the Springfield plant did not exceed 2.41 per cent. and the greatest difference between the maximum and minimum variation during this time did not exceed 3.16 per cent. The variation from the mean rate of filtration at the Baisley's plant did not exceed 1.7 per cent. during the same period and the difference between the maximum and minimum did not exceed 2.1 per cent.

The daily operation is carried on with practically the same methods that were followed in making these tests and the same detailed results for each day's operation have been recorded since the plants were accepted by the city. The water from the Springfield Pond is more flashy in character than that from the pond at Baisley's, but both supplies are at times low in turbidity. The loss of head in the filters during these periods of low turbidity is not indicative of the condition of the sand bed, it has been found, and the filters have to be washed occasionally under such conditions when the lost head does not exceed 2.5 ft.; otherwise the coagulant penetrates deeply into the sand. Some slight difficulty has been experienced from a heavy growth of anabena in the pond at Baisley's, but the use of copper sulphate has relieved this condition.

The plants were built for the Department of

Water Supply, Gas & Electricity of the Borough of Brooklyn of New York City, Mr. I. M. De Varona, chief engineer. Mr. Geo. W. Fuller was consulting engineer during the construction. Messrs. J. P. Cranford & Co., of Brooklyn, built the plants, Mr. Robert Spurr Weston being their consulting engineer on the work. Mr. Bernard M. Wagner, assistant engineer, was in immediate charge for the city during the construction and tests, and was assisted by Mr. Wm. F. Laase. The operation of the plants is now under the immediate direction of Mr. T. D. Long Coffin.

United States Patents numbering 30,824 were issued in 1904, 110 were reissued, and 20,429 expired. The balance to the credit of the Patent Office on Jan. 1, 1905, was $5,863,867.



Views taken during the Erection of the Bellevue Highway Viaduct.

The Erection of the Bellevue Viaduct.

The Bellevue viaduct across Spruce Run Ravine, near Bellevue, suburb of Allegheny and Pittsburg, has a total length of 855 ft., a maximum height of 125 ft., is 30 ft. wide and contains about 500 tons of structural steel. It is calculated to carry a double-track electric railway, is planked for highway traffic and has a 6-ft. sidewalk supported by light cantilever brackets on the outside of each line of girders. It is proportioned for a live load of 100 lb. per sq. ft. of roadway and sidewalk surface and for a concentrated load on each of two axles of two coupled motor cars. The materials, workmanship and general features of the design correspond to standard highway bridge practice and present no points of unusual interest.

The structure consists of alternate spans of 28½ ft. and 57 ft., supported on steel towers. Each span has two lattice girder trusses 6 ft. 4 in. deep and 16 ft. apart on centers, which are seated on the horizontal cap plates of the tower columns and have their end lower chord connection plates so arranged as to fit into the column and become integral with it, affording connection for the column bracing. Each tower is composed of two vertical transverse bents with two columns battered 1 to 6 and has horizontal struts and X-bracing on all sides. The horizontal struts have a maximum length of 50 ft. and all of them are supported at the center by vertical suspension from the intersection diagonals in the panel above. All diagonals are made with pairs of angles connected by tie plates. The girders of successive spans are riveted continuously together except at expansion points every 85½ ft., where one girder is provided with a sliding end secured by bolts through slotted holes.

The material was all shipped from the bridge shop to grade at one end of the viaduct, where it was unloaded by a stiff-leg derrick and delivered to platform cars on a 17-ft. gauge service track carried forward on the deck of the finished structure as rapidly as the latter was completed. At the commencement of operations a cantilever traveler was built on shore at the first abutment and erecting the first panel of the viaduct, moved forward on it and erected the second, then moving on and erecting the third and so on for the whole of the work. The traveler was built entirely of wood and consisted substantially of a pair of cantilever trusses 125 ft. long over all, 22 ft. deep, 19½ ft. apart, with a base of 34 ft. and an overhang of about 91 ft., the base and overhang being respectively a little greater than the lengths of the tower and connecting spans. The trusses were braced by top laterals and by swaybracing, as indicated in the rear elevation.

The lower longitudinal sills of the traveler were provided with two roller nests, each having eight 3-in. rollers at the foot of each transverse bent, four nests in all, which moved forward on a track composed of two T-rails laid close together on top of 10x10-in. special cross ties. These rails form sections of a track of 19½ ft. gauge and were taken up in the rear and laid in front as the traveler advanced. Between them were laid the rails of a service track of 17-ft. gauge on which a special car delivered the materials between the trusses of the traveler.

The lattice girder spans were assembled and riveted up complete, including stringers in the material yard at the end of the viaduct and were delivered on the cars under the traveler. Two six-part tackles suspended from the upper part of the traveler were then attached by chain slings to the center top chord of each truss of the span. One of these tackles was secured to the traveler at the forward main bent and the other was suspended from intermediate jigger beams laid across the top chords of the overhang. This arrangement enabled one set of tackles to be operated while the other was slacked off so as to fleet the span longitudinally and lifting it from the car moved it forward until the front end would be seated on the tower already assembled to receive it. This operation was successfully accomplished so rapidly that a 21-ton, 57-ft. span was set in its final position as soon as 35 minutes after it left the material yard.

The erection of the towers was easily accomplished in advance of the erection of the spans by means of the 35-ft. boom of an A-frame derrick seated on the extremity of the cantilever arm of the traveler. A shear arm was also erected on the overhanging top chords of the traveler and provided with tackles for handling the material for towers. Various small tackles, whip lines and other ropes were attached to the traveler at convenient places and enabled all of the members and materials to be rapidly handled.

The traveler was counterbalanced by a six-drum Lidgerwood hoisting engine seated on the platform laid across the rear end of the top chord. The total weight of the traveler, engine, boiler, stores and rigging was about 88,000 lb., arranged so that the traveler could be used for tower construction without anchorage. The traveler was anchored to the structure when heavy lifts were made. Additional stability was secured by suspending from the rear bent some structural steel members weighing about 20,000 lb.

Steam for the hoisting engine was generated in a boiler fired with natural gas brought to the superstructure in a 2-in. steel pipe and connected to the traveler with a flexible hose. All of the field rivets were driven by Chicago pneumatic hammers operated by air at 100 lb. compressed in an Ingersoll-Sergeant machine using steam, which also was generated by gas fuel. The viaduct was painted two coats of Nobrac coating paint.

The viaduct was erected in 24 working days by a total force of about 60 men, including 10 men to operate the traveler and erect the material, seven four-men gangs of riveters and the painters. Considering the light materials, the rapidity with which the work was erected is believed by the contractors to be unusual. The viaduct was designed by Mr. J. H. Uhlenhaut, chief engineer for Pittsburg Railways Company, who are its owners. The general contract was awarded to the Riter-Conley Mfg. Co. The superstructure was built in their plant at Allegheny, Pa., and was erected by their erecting department. The substructure, consisting of concrete abutments and concrete piers, under the tower columns, was built by a sub-contract awarded to Fred Wellsman.

A Steel Wharf at Lome, Africa.

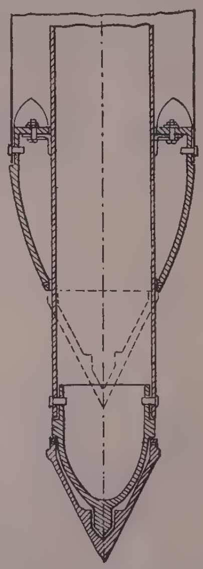
The town of Lome is one of the two seaports of the German colony of Togo, on the Gulf of Guinea, near Dahomey. A sandy bar is formed by the action of the prevailing winds, which prevents the approach of ships and has heretofore made it necessary to transfer passengers and freight by lighters. To avoid this there has just been built by a Nuremburg firm a steel wharf about 1,000 ft. long which extends across the bar to deep water. The details of construction are unusual as regards the substructure, and the method of erection is specially so in that it corresponds to that generally used in America for the erection of lofty viaducts.

The superstructure consists of double-track, plate-girder spans of about 65½ ft., 78½ ft. and 92 ft., and 15 ft. in the clear above mean water level. These rest on steel piers consisting of single transverse girders with rocker bents supported on pile tripods at each end. The 65½-ft. shore span is made with girders 78½ ft. long, which, at the sea end, overhang the pier 13 ft. and at the shore end are anchored with a longitudinally sliding connection. The second span from the shore is supported on piers 78½ ft. apart, and is made with plate girders 106 ft. long, which cantilever 13 ft. at each end and support the extremities of 65½-ft. center girders in both adjacent spans. The arrangement of the remaining spans is similar except that in one case the order appears to be varied, and two 78½-ft. spans, apparently continuous, are adjacent to each other without an intervening cantilever span. At the sea end the girders cantilever 13 ft. beyond the last pier, and in the last two spans they are spaced 32.8 ft. apart instead of 20 ft. c. c., as elsewhere.

The ends of the cantilever and suspended girders have the panels between vertical web stiffener angles reinforced by diagonal angles riveted to the webs. The 32.8-ft. floor beams are plate girders; all other floor beams are I-beams, as are the stringers. The lower flanges of the floor beams are flush with those of the main girders, and their girder connections are made with gusset plates extending to the top flanges of the girders. The longitudinal girders are connected by a curious system of laterals, which are apparently semi-diagonals, intersecting and terminating on the bridge axis so as to form a herring-bone pattern, except at each pier, where they are continued across the end panels to intersect on the center of the transverse girder.

The longitudinal girders are seated on the top flanges of the transverse girders, all of which are about 33 ft. long and cantilevevr slightly beyond their supports, which are 26 ft. apart on centers. Each support is V-shaped in transverse elevation and consists of two inclined columns riveted across the girder web and converging to a hinged connection at the foot, where it rests on a shoe on top of the pile tripod just above high water level. Neither these rocker bents nor the pile clusters have any longitudinal or transverse bracing, and all the rigidity of the structure is due to the inclination of the members of the substructure and to the floor bracing, which latter includes, besides the diagonals previously mentioned, a horizontal knee-brace strut from the end of each main girder to the transverse girder. The sea end of the wharf is equipped with a one-ton, hand-fixed hand derrick and two traveling gantries with 5-ton revolving steam derricks.

The three piles constituting the cluster at each end of each transverse girder are steel tubes ½ in. thick and 10 in. in diameter. The upper end of the pile is enclosed in a steel shell ¼ in. thick and 18½ in. in diameter, provided with a two-part, cast-steel conical shoe. It was first driven, at the required angle with the vertical, to a depth of about 6½ ft., and then the pile was inserted in its axis, engaging a water-tight, rubber gland in the upper part of the shoe. The foot of the pile had a cast steel point with a spur engaging a centering cavity in the shoe point, and when the pile was driven it broke off the small bolts connecting the two parts of the shoe and forced the shoe point down with it, leaving the upper part of the shoe to form a collar around the pile and close the foot of the pile shell. After the three piles of each cluster were driven to the required depth by a hammer their tops were united by a riveted cap with three divergent struts, one of which was inserted in each pile, and the piles and pile shells were filled with concrete. The pile cap was also enclosed in molded concrete extending to the shoe for the rocker bent.



Steel Pile for Wharf.

The erection of the wharf was accomplished with a steel overhead cantilever traveler supported on the completed spans and building out one panel in advance. It had two deep lattice girder trusses 170 ft. long, connected by overhead lateral and transverse bracing and carrying two trolleys with differential hoists, by which materials were transported from one end to the other and the wharf members assembled. The forward end was equipped with shear legs and a pile driver, and the rear end carried a steam hoisting engine, boiler, etc. Operations were commenced in the latter part of 1901, but so many difficulties were encountered that it took a year to erect the first span. Afterward the conditions were less unfavorable and the spans were erected at an average rate of one a month. General drawings of the wharf and photographs of the erection were recently published in the "Genie Civil," of Paris.

Tests of Railroad Tie Plates.

At the request of Mr. Garret Davis, chairman of the Track Committee of the American Railway Engineering and Maintenance of Way Association, certain tests were undertaken in the testing laboratory of the State University of Iowa, to determine the efficiency of tie plates in preventing the overturning of rails by lateral pressure against the head. Mr. Davis furnished a number of ties and pieces of rail, and the various manufacturers furnished the tie plates used in the experiments. In addition to the overturning tests, a few tests were made with lateral pressure applied at the base of the rail. A description of the work is given by Prof. Wm. G. Raymond in the "Transit," from which the following notes are taken.

For the overturning tests a short piece of rail was spiked to the tie, placed in the testing machine, and pressure was applied at the upper edge of the straight side of the head of the rail. The American Society of Civil Engineers 80-lb. rail section was used, with the following plates: Wolhaupter Q. & W. 6 x 8 x ¼ in. thick, weighing 3 lb., 13 oz.; Goldie Claw, 6 x 7 x ⅜ in. thick, weighing 4 lb. 14 oz.; Glendon Flange, 6 x 8 x 9-32 in. and 11-32 in. thick, weighing 5 lb. 10 oz.; Atlas, 5 x 8 x ¼ in. thick, weighing 3 lb. 3 oz.

While the tests are insufficient in number to warrant very positive statements, they seem to clearly indicate that with very soft wood ties, plates give some little additional security against overturning, and that with ordinary hard wood ties, no additional security is obtained by their use. It seems also to be clearly indicated, as was to be expected, that for security against overturning, the double spiking, if used at all, should be on the inside of the rail; and that two spikes resist about twice the lateral force resisted by one.

In tests to determine the efficiency of plates in resisting lateral pressure rather than overturning moment, the pressure was applied against the inside of the base of the rail, and, without any other purpose than a certain convenience in handling, different weights of rails were used in these tests.

The conclusions that seem to be warranted by these few tests are given by Prof. Raymond as follows:

1. There is a decided advantage in the use of plates, due probably to the fact that all of the spikes are brought into bearing, and to the help of the projections on the bottom of the plates.

2. There is a decided advantage in plates whose projections cross the grain of the tie.

3. There is a decided advantage in the use of heavy plates.

4. If no plates are used, and there is any double spiking, it should be on the outside of the rail; while if plates are used it makes little difference, whether it is on the outside or inside.

The general indication of both sets of tests seems to be that double spiking when used on only one side should be on the inside of the rail, whether plates be used or not.

The Shippenburg, Pa., Reservoir has again failed to hold water, and the Vulcanite Paving Co., which has a contract for keeping it water-tight for five years, is working on the basin again, although it finished repairs not much more than a fortnight before the last break occurred. It must not be inferred from this, however, that the work was not carefully done, for the basin has shown an extraordinary inability to serve its purpose. It has now been two years or so since the first of these troubles occurred and an account of them would form a decidedly interesting series of notes on the difficulty of building a tight reservoir on a seamy location.

The Telephone Tunnels in Chicago.

Early last month the Commissioner of Public Works of Chicago appointed Messrs. John M. Ewen, Edward C. Shankland and Louis E. Ritter as a commission to study the tunnels of the Illinois Telephone & Telegraph Co. in all their phases. Their report was made last week and is a very interesting document, opening with the history of these tunnels. On June 27, 1898, an ordinance was introduced authorizing the company to operate in all parts of the city, provided its wires were buried in the heart of the city, the municipality was furnished telephones free, and the maximum private rate was not over $85. This ordinance was passed in January, 1899, was vetoed, and finally passed in amended form on Feb. 20, 1899. A few months later the company leased patents controlled by the Strowger Automatic Telephone Exchange Co., and in August of the same year began surveys for its underground wire system.

The first construction was a shaft in the rear of 170 Madison St. and a tunnel started toward La Salle St. A year later, the company filed amended articles with the County Recorder, giving power "to distribute, convey and deliver telephone messages, telegraph messages, packages, mail, newspapers, and general merchandise, and to convey, distribute, deliver and furnish power, heat, light by steam, water, air, electricity or otherwise, but not by railroad." From the summer of 1900 until September, 1901, no work was done, owing, it was officially stated, to the necessity of making surveys. On Feb. 24, 1902, President Wheeler of the company stated that 6 miles of tunnel had been built in the downtown district, and that the order of business proposed was as follows: 1, To carry the service wires of the company. 2, To carry city police and fire alarm wires. 3, To carry mail matter between the Chicago post-office and the railroad depots. 4, To carry newspapers from the various publication offices to the depots. 5, To carry eventually all other telegraph and telephone wires. 6, To transport freight, if the city gives its consent. After considerable public discussion, an ordinance was passed in July, 1903, which specified that the tunnels should be at least 19 ft. below city datum, although the first permits for the work called for a depth of but 13 ft., or about 27 ft. below street grade.

The tunnels are constructed of concrete, 10 in. thick on the crown and sides and 13 in. thick on the bottom. All the main lines, including many of the bypasses and curves at the intersections, were constructed under an air pressure of about 9 lb. The method of construction was as follows: The bore was dug in the clay for a distance of 20 ft., and about a foot larger all around than the completed tunnel was to be. The 13-in. concrete bottom was then put in place, and on this were placed forms made of 5-inch. channel bars in two pieces, and curved to the exact size of the inside of the completed tunnel. Outside of these forms, boards 20 ft. long were placed one at a time on each side, and the concrete rammed into the space between the boards and the clay. When the crown forming the key was reached, boards 3 ft. long were used. It was afterwards found better to build 15-ft. sections instead of 20-ft. The concrete was composed of one part Portland cement, 3 parts sand and 5 parts gravel.

Before the outlet to the lake front was built, all the clay was hauled away from head houses located in the streets on the curb lines at various places. This hauling was done entirely at night.

The size of the tunnels was fixed in September, 1899, shortly after active work was started. The cross-section determined upon was of the horseshoe form 6 ft. wide by 7 ft. 6 in. high, inside dimensions. These dimensions were proposed by the company and approved by the city officials. The company proved to the satisfaction of the city authorities that these dimensions were necessary to provide sufficient space for stringing the wires and allowing room for a man to pass between them. This cross-section has been maintained throughout the work. It would seem that experience has shown a way to arrange these wires in a more compact form, and thereby leave room for the passage of electric locomotives and freight cars.

In 1901 the company started to construct the trunk line tunnels 12 ft. 9 in. wide by 14 ft. high, obtaining a permit for this work from the city engineer on the plea that as it was impossible to construct manholes in the streets to the tunnels on account of the existing conduits of the Chicago Telephone Co., the Chicago Edison Co., and others, it became necessary to construct these large tunnels in order to introduce therein their large cable reels and transport them through these large tunnels so as to allow the cables to be run into the small tunnels. The action of the city engineer in granting permits for these trunk line tunnels under the 1899 ordinance was ill-advised, the commission states, but at the same time it feels that no blame should be attached to him and the criticisms that were made upon him in consequence it considers unjust. The commission believes that he was deceived by the pleas which were advanced to show the necessity of the large tunnels. Work on these large bores was stopped, and although they were afterwards legalized by the ordinance of 1903, no further attempt has been made to build tunnels of this size, so that only about 100 ft. have ever been built.

From an engineering standpoint it is to be regretted that a work of such magnitude should have been prosecuted without having had the basis of a coherent and comprehensive plan. An enterprise of such great importance as this should have been carefully and thoroughly studied out in detail. Before work was begun complete plans and specifications should have been prepared, showing the work contemplated, materials to be used, and the method of construction. In the case of the London subway, a Royal Commission, which called in the assistance of consulting engineers, has labored for three years and their report is just being published.

When the size of the bores 6 ft. by 7 ft. 6 in. was established, the idea of using the tunnels for freight, in addition to their use as tunnels for wires, was not disclosed by the company, nor considered by the city. When the trunk line tunnels were abandoned, probably on account of cost and increased danger of construction, the freight carrying scheme had to be fitted to the existing 6 ft. x 7½ ft. tunnels. On the other hand, the best evidence of the practicability of carrying freight through these smaller tunnels, is the fact that many railroads entering Chicago have recently become interested in the project.

The Commission has not been able to find any authoritative statements concerning capacity of the tunnels to carry the amount of freight claimed, the proper speed for trains, the safe regulation of grade crossings, etc. These questions have not as yet been determined by the company and very probably will not be settled until demonstrated by actual practice. It considers this entire matter should receive the most careful investigation and consideration of competent railroad men.

It is a matter of great concern to decide how these tunnels shall be regarded, whether as public highways or as the premises of a private corporation. On the point of view taken by the city will depend the solution of the problems of safeguarding the public or employes of the company against crime, accident, fire, breaking down of power and light plants, etc. There is no provision for emergency exits from the tunnels in case of accident.

The control and supervision by the city of the work of building these tunnels has been lax when compared to similar work done for private individuals or corporations. Ordinary practice demands a definite official plan and specification, and a sufficient force to properly supervise the work at all points and at all times; while in this case there were no definite plans and specifications, and there was but one city representative in the supervision of the entire work. The Commission finds the city records of the work very incomplete, for example, it has been unable to find any written specification either for the cement or the concrete. It has been unable to find any official survey showing the exact location of the tunnels. It also finds that no attention has been paid to the time clause provided for in the ordinance.

In regard to the effect of these tunnels on the streets and buildings of Chicago, the Commission says that the work in the downtown or loop district may be properly divided into two parts; first, the construction of the tunnels built chiefly between 1900 and 1902, which were constructed under air pressure; and second, the construction of the connections and bypasses from these tunnels which have been built more recently and without air pressure.

The Commission has been unable to find any evidence of any settlement due to the first part of the work, that is, the building of the main line tunnels under air pressure. Any such settlement would result from two causes. The first is the movement of the clay above during the process of excavation or through faulty ramming of the concrete. Such a movement would take place at the time the work was being done or very soon afterwards. The other cause of settlement would be the shrinkage of the clay due to the drawing therefrom of the water. The seepage would be very slow as would also be the resultant settlement. The seepage through the tunnel walls would be apparent, of course, in the tunnels. As a matter of fact the tunnels were found to be fairly dry. Much of the moisture was found to be due to condensation. The Commission has information from trustworthy sources that the tunnels have at all times been fairly dry, and as a large part of the tunnels in the downtown district have been finished for three years, it would seem that the danger of settlement due to drainage of the clay has little evidence to support it.

It is a fact that there are now seventeen electrical pumps installed in this tunnel system. The question as to whether the water in the tunnels that is now being pumped out is entirely water of condensation, or seepage, would require a special investigation lasting through several seasons. As an indication of the small amount of water being pumped at present from the tunnels, the Commission has been informed that the total bill for Edison current for running all these pumps during the last month was less than $100.

In regard to the settlements due to the second part of the work, that is, the building of connections, bypasses, and new drifts without air pressure, the evidence is at hand and convincing. A number of cases of settlement of streets and buildings were traced to this part of the work, and unless some other means of operation are adopted or the greatest care used in construction, there may be further settlements. The Commission has not had sufficient time to prepare a plan for minimizing the danger and therefore has no remedy to offer at present.

If the tunnels have been built in accordance with the cross-section submitted and if the work has been properly carried out the Commission considers their strength to be ample. But the physical condition of an engineering structure is manifested by its plans and specifications, and the evidence that these plans and specifications have been carried out. This evidence is not available in this case, but the Commission says that the concrete work appears to be of the best material and workmanship and it has no reason to believe it otherwise.

On July 31, 1905, 173,530 ft. of tunnels had been completed and work was being pushed rapidly.

Large Gas Engines in Europe.

The development of large gas engines can be said not to date back further than five to six years, according to a paper by M. E. R. Mathot, presented at the recent Liege meeting of the Institution of Mchanical Engineers. Eight to ten years ago they were initiated simultaneously in Germany, England and Belgium, early attempts being made to utilize blast-furnace gas, which was expected to open up such a vast field for the employment of large engines. Although the first trials were only attempted on small engines, the results of the experiments soon gave encouragement to the efforts of the investigators. The Cockerill Co., of Belgium, constructed a single-acting Otto cycle engine of 200 hp., which has been working regularly at their establishment for six years. This stage in the path of progress was strongly accentuated by the 600 hp. engine on the Delamarre-Deboutteville system, which the Cockerill Co. exhibited at the Universal Exhibition at Paris in 1900. This was single-acting, the piston having a diameter of 4 ft. 3 3/16 in. and a stroke of 4 ft. 7⅛ in. It was designed to develop its power at 80 r.p.m., which, with an initial explosive pressure of 310 to 325 lb. per square inch, produced on the piston a pressure of 300 tons at each explosion.

In a short time several famous firms entered, in their turn, upon the construction of large engines intended to utilize the gases liberated by the various reactions occurring in the manufacture of iron, coke, etc., and the metallurgical industry was not long in entering upon the path of progress by replacing for its old boilers and engines powerful installations of explosion engines. Although the theory of gas engines has rested up to the present on a series of hypotheses which have not yet received experimental confirmation, these engines have gained ground in application to various industries with exceptional rapidity compared with any other kind of motive power. The invention of gas producers and the improvements made in the last few years, and especially in those working with the direct suction of the engines, are manifestly most important factors in this success.

Before examining the successive developments of these producers, the principal phases of the improvements through which the engines themselves have passed will be analyzed. It was first of all in Germany, and then in England, that their construction underwent the most rapid development. Afterward America was the country which produced the greatest number. It is, therefore, not surprising to notice that each type has retained in its construction or design something which, as a birthmark, reveals its nationality.

The German engine, M. Mathot said, has always presented the appearance of a well-finished machine as regards constructional details—all the parts machined were usually polished bright, which disclosed a real anxiety on the part of the makers to impart a high finish to their machines. This, of course, affected the price, but the life of the engine was materially increased thereby. There are cited as examples of longevity certain "rack" engines of the Otto-Langen type and make, which are completing a career of thirty years' service.

The English makers took up another position, namely, that of producing cheaply in order to produce on a large scale. Thus we are indebted to them, in M. Mathot's opinion, to a great extent for the propagation of small engines for industrial purposes. English engines, designed for the use of town gas vie with each other in ingenuity in the arrangement of their parts in order to attain efficient and simple mechanical devices. The lift of the valves and their mode of operation are in general obtained by cam and lever movements with a definite movement giving a positive action. The "hit-and-miss" governor itself is reduced to its most simple expression. Unfortunately, this type of governing is not compatible with the requirements of the working conditions of modern large engines.

The merit of having entered upon the new path which the construction of gas-engines has followed for five or six years undoubtedly belongs to the Germans. The old makers of gas-engines in Germany took the initiative of departing from old methods. In a short time their processes were themselves improved and perfected by the makers of steam-engines, long accustomed to circumvent or overcome practical difficulties in the construction of large engines. Without large gas-engines tending towards a single type it may be said that they all have manifest tendencies to resemble the modern steam-engine from the point of view of their form and valve gear.

Regulation.—The "hit-and-miss" system of regulation has been completely abandoned, M. Mathot said. This system does not lend itself to working with very light charges, or with no charge, in the case of engines fed by suction gas-producers. As in these circumstances the gas supply alternates with three, four or even five strokes with no charge, it happens that the suction which determines the supply of air to the producer is not sufficiently uniform, and that the fire finishes by being extinguished, or, to say the least, by producing a very poor gas through the lack of activity in the furnace.

It is, therefore, towards the system of admission of a variable quantity of mixture, but of uniform composition, that makers have directed their path. A few English makers, Tangye, Willans and Robinson, also Westinghouse, decided the question by throttling, by means of a butterfly-valve or a cylindrical slide-valve, the mixture regulated in advance; this butterfly-valve or slide-valve being controlled by the governor and placed immediately before the valve admitting the mixture to the cylinder. The principle was still further improved by an automatic mixing valve, preceding this regulating device, as constructed by Benz in his four-cycle engines. However, the majority of the Continental makers, with the object of obtaining a prompter and more reliable action of the governor, have endeavored to combine under one single control and in a single device the slide or inlet valve and the mixing valve, and, instead of throttling the charge in the passage, they have provided the mixing valve with a variable stroke under the action of the governor. The application of this device has not, however, been extended to very large engines, as it was found to be too heavy and cumbersome to handle and dismantle for the purposes of cleansing. Admission in variable quantity of a uniform mixture involves variable compression and the necessity of a high original compression. If for the full admission of the charge this compression was from 170 to 200 lb. per sq. inch, it might fall to less than 45 to 55 lb. for the minimum admissions, which would interfere with the prompt ignition of the very poor mixtures which are at the present time used in engines applied for industrial purposes. Further, this mode of admission produces at the time of the suction with light charges a vacuum or negative work which would become considerable in engines of high power. This has been avoided by combining with the variable admission of the constant mixture an additional admission of air or impoverished mixture, in order to effect at the same time the constant compression and minimum vacuum in the cylinder.

Control.—The lift of the valves, which is usually effected in the old engines by simple movements of levers at one end of which a cam acts upon a roller, has also undergone some alterations. In large engines this has been replaced by eccentrics and "roller-path" levers, thus imitating what is applied to steam-engines of the Sulzer type. Some special valve gears have even been provided with ratchet movements with air-pistons, such as Cockerill's and Nürnberg's. The main object of these improvements has been to secure a more gentle and silent action relative to the size and weight of the parts to be actuated.

It is advisable to bear in mind with regard to English and American engines that the compression generally adopted for large gas-engines is from 170 to 200 lb. per square inch.

Cooling.—Cooling is one of the points which has most attracted the attention of makers of large gas-engines, as the effects of tension in the castings, due to unequal expansion, play a considerable part in the heavy pieces which enter into their construction. Cylinder heads or explosion chambers have been, in fact, one of the principal sources of difficulties and disappointment, as without any apparent reason they fracture at the most unexpected places. It is only long experience, assisted by numerous examples, which has placed makers on the track of the most appropriate forms for securing the strength of cylinder heads, rather than the selection of the materials to be employed in their construction. Steel itself has been tried without success.

The principal factor for the preservation of cylinder heads is the manner in which the cooling water circulates therein, and the type which appears to be favored at the present time for Otto engines is the one which places the inlet and exhaust valves in the same vertical axis. Both are placed in a passage or ante-chamber surrounded on all sides by the cooling water. In order to secure for the whole of the parts an equal expansion this chamber is arranged symmetrically relatively to the axis of the cylinder. The exhaust is allowed to discharge on the extension and is surrounded as completely as possible by water. An abundant circulation is thus provided around the seat and the stem of the exhaust valve, which is also provided with an internal circulation in the case of large engines. The water which has entered at the bottom of the cylinder head escapes at the top, or if need be in the case of engines of less than 75 h.-p. completes its circulation in the jacket of the cylinder proper.

In order to combat the excessive temperature which attends high compression, certain makers, amongst whom we may mention the Nürnberger Maschinenbau Co., have even provided the piston ends of their single-acting engines with a water circulation. This is effected by a pump forming part of the engine. This is evidently a complication which others have easily avoided for engines even of 150 h.-p., by arranging the piston so that a free access of air, due to the to and fro movement, alone effects the cooling. In order to derive every economical advantage from high compression without running the risk of self-ignition, the firm of Koerting has even arranged inside of the explosion chamber of their Otto cycle engines a hollow casting through which there is a special water circulation. This cooling effected in the very heart of the mixture deals with the excessive temperature there, and is said to have given the best economical results. In double-acting engines the cooling is still the object of great attention, and apart from the cylindrical jacket and cylinder ends, independent water circulation is used to cool the piston and piston-rods, the seats of the exhaust valves, and the stuffing-boxes. The general temperature of the surrounding parts is kept cooler than in English engines, M. Mathot said, and for this purpose water is delivered at certain parts, such as the piston and piston-rods, at pressures from 15 to 60 lb. by means of a special pump.

It appears from several experiments which M. Mathot has made on double-acting Otto cycle engines that the quantity of circulation water required per brake horse-power for the different parts of engines of 200 to 1,000 h.-p. is as follows.

	Imp. gal.
Cylinders, cylinder ends and stuffing-boxes	4 to 5¼
Pistons, piston-rods	1¾ to 2¾
Valve-boxes and seats, and exhaust valves	⅞ to 1⅜
Total	6⅝ to 9⅜

These figures imply water admitted on an average of 53-59° F. and leaving the cylinder jackets at 77°-95° F., the pistons at 95°-104° F., and the valve seats and boxes at 113° F., on an average. An engine of 1,000 h.-p., of the two-cylinder double-acting type, would therefore require about 8,900 imp. gal. of cooling water per hour. As this is an excessive quantity which is not available at every works recourse is commonly had to the use of cooling towers which reduce the consumption of water to about 1-9 gal. per horse-power hour, absorbed by evaporation. This method has also the appreciable advantage over the ordinary water circulation of eliminating, owing to the continuous use of the same water, the deposit of calcareous incrustations. Without possessing in the case of gas-engines the same dangers as in steam-boilers, lime scale and deposits still constitute a drawback. They obstruct the pipes and passages, and impede the regular cooling by coating (with a non-conducting material) the metal at the places where a high temperature is most injurious. At the parts cast with a double jacket, and which cannot be dismantled, it is necessary to arrange large openings covered by bolted lids in order to enable free access to the inside to remove these deposits.

Ignition.—This question has for some years been solved in a satisfactory manner by the use of magnetos producing a spark on the break of the circuit which in a short time has ousted all the old method of ignition, such as the incandescent tube, the spark produced by batteries and accumulators, by dynamos, etc. This modern magneto ignition has for three years been provided with a timing gear, by means of which the ignition can be advanced or retarded experimentally during work. With the increase in dimensions of engines it has been necessary to deal with greater volumes of explosive mixtures but of poorer composition. This has led many makers to provide their double-acting engines with two distinct ignitions for each piston face, the one placed near the inlet-valve at the top and the other at the bottom near the exhaust-valves.

Starting.—A few words remain to be said on the starting of large engines to which the explosion "self-starter" has not been applicable. The apparatus, which causes behind the piston the explosion of a mixture previously introduced into the cylinder when the engine is stopped, develops a too sudden and violent strain, owing to the resistance of the inertia of the parts at rest. Moreover, the action of this apparatus is too precarious. Use is therefore made of air compressed to 150 to 225 lb. by a compressor and stored in a reservoir. When an engine has to be started, the crank is placed in the starting position, corresponding to the explosion stroke by turning the fly-wheel by means of a lever or a system of gearing. In the case of the single-acting engines a charge of compressed air is introduced by operating by hand a valve at the end of the cylinder head of the engine. This operation is repeated several times in succession until the engine, sufficiently started, draws in the explosive charge and drives itself. In the best double-acting engines the starting-valve working by compressed air is generally operated mechanically by the halfspeed shaft.

Lubrication.—Lubrication has also of late formed the subject of important improvements. In engines of medium power, *i. e.*, up to 150 to 200 h.-p., the main bearings of the crank-shaft are usually lubricated by means of a revolving ring plunging in an oil bath. For larger engines bearings with brasses consisting of several parts, to take up the wear and the working stresses, are used. As this system renders it impossible to apply the lubricating ring which gives such good results in dynamos, recourse has been had to continuous oil-feed under pressure. This pressure also secures a more reliable lubrication of large surfaces supporting great loads, as is the case with the crank-shafts of engines of 1,500 to 3,000 h.-p. which exceed 1 ft. 7 11-16 in. diameter. For lubrication the pistons and the stuffing boxes of the piston-rods, oil-feed under pressure is a necessity, as the oil is more reliably conveyed to the rings, the tightness of which depends to a great extent on the free play secured to them by proper lubrication. Excess of oil in the cylinders which, by rendering them dirty, is the principal cause of "back firing;" this has also been greatly reduced by the use of a draining device to the cylinder.

Consumption and Efficiency.—Modern large engines have attained high organic efficiency owing to the proportional reduction of their weight and the finish of their construction. Double-acting engines are usually made with a weight of at least 220 lb. per horse-power. It is admitted that Otto cycle double-acting engines attain 90 to 92 per cent. mechanical efficiency, whereas an output of only 75 to 80 per cent. was attained by two-cycle engines. This waste, being due to the work absorbed by the air-pump and by the gas-pump, cannot, however, diminish the value of the engines of which the Oechelhäuser and the Koerting are types possessing their own advantages. Double-acting Otto cycle engines attain a thermal efficiency of 28 to 30 per cent. relatively to the effective work, *i.e.* the horse-power hour is attained with about 8,729 B.t.u. This consumption converted into the volume of the different gases used industrially would be as folows: Coke-oven gas, 20.7 cu. ft.; Mond producer-gas, 62.2 cu. ft.; anthracite producer-gas, 65.4 cu. ft.; blast-furnace gas, 88.3 cu. ft.

Future Improvements.—Economically the gas-engine is evidently superior, but low consumption is not the only quality which users require from a motive power. It is necessary above all that it should be free from the risk of sudden stoppages which lead to great expense, as they hamper production and may be at times fatal in certain industries where breakdowns must be specially avoided; such is the case with electric stations, pumping, hoisting and ventilating work in mines, etc. The principal causes of breakdowns in engines fed by gas other than town gas, which undergoes a complete purification, consists in the fouling of parts, such as the pipes, the valves and the cylinder, by impurities in the gas.

In large installations where it is extremely important to avoid breakdowns, recourse is had to special means of washing and purifying, by the use of centrifugals and other apparatus. But although these succeed in reducing to 1-5 gramme per cubic metre the amount of dust accompanying the gas, they still allow the passage of tar, which is the principal element destructive to the engine. This tar adheres to the sides of the passages, causes the valves and piston-rings to stick, thus preventing their proper action. It also deposits itself in the cylinder where it finally gives rise to premature ignitions.

Certain coke-oven gases are said to contain is this very question of tar which compels us, in as much as 1 gramme of tar per cubic metre. It order to avoid great complications, to employ exclusively non-caking anthracite coal for suction gas-producers now so largely in use owing to their simplicity and economical efficiency. As tar is a product of distillation of the volatile carbons (carbides) which escape on combustion and on the conversion into fuel gas, it is to our interests to reduce them in the producer itself. Different systems have been proposed, amongst which is the system of inverted combustion, which is said to have the result of burning the volatile matters as they are given off and the distillation of the hydrocarbons in the independent reducers. It must be admitted that so far the efforts of the inventors have not met with the success expected. The caking of the fuel and the formation of cavities injurious to the regularity of combustion constitute the principal difficulty to combat. The use of bituminous coal, especially in suction gas-producers, is not therefore a question which has been industrially accomplished.

Driving Piles and Handling Earth with Hoisting Machines Operated by Electricity.

Whether it is producer gas, blast-furnace gas, or coke-oven gas which is used, their purity is an important factor in the proper working of the engines which they feed. The organic defects of large engines do not appear to play in this respect a preponderating part. They should, however, be perfected as regards facility of access and upkeep of the parts, such as valves and piston.

The oil consumption should be kept as low as possible and these large engines must be made less susceptible to variations in the quality of the gas supplied to them.

Electric Installation for Contractors' Plant on Brooklyn Anchorage of Manhattan Bridge.

The Brooklyn anchorage for the cables of the 1,470-ft. span of the Manhattan suspension bridge across the East River at New York, involves in its construction a large amount of pumping, pile driving, earth excavation, and the mixing, handling and transporting of 40,000 cu. yd. of concrete, as described in The Engineering Record of August 12. The time allowed for construction is 450 days and in order to economize in the handling of large quantities of materials and if possible to earn a bonus of $500 a day for completing the work in advance of the contract time, a very careful study and comparative estimates were made of the conditions. It finally seemed that a complete electric plant, although involving a large original expense, would secure the best ultimate results.

The system provides for the use of power instead of hand labor wherever possible. Its important feature is in the absence of any steam plant except a single boiler to operate a high pressure pump, and the installation of electric apparatus for all kinds of service, chiefly pile driving, hoisting, traction, concrete mixing, pumping and lighting. The advantages gained are large total economy, saving of space, elimination of boilers, steam engines and their repairs, reduction in number of skilled workmen, flexibility of apparatus, lightness and portability of plant, no waste of power when work is not being done, and ease of keeping classified costs for different kinds of service, by means of switchboard records.

The plant is located in two adjacent yards on opposite sides of Plymouth St., parallel to the river front. On the river side there are two long docks, hoisting, conveying and dumping apparatus, a concrete mixing plant, and several lines of standard gauge tracks occupying an area about 550 x 160 ft. in extreme dimensions. On the other side of the street the 500 x 250-ft. yard of irregular outline covers the intersection of two streets and occupies parts of four city blocks. In it are the contractors' and resident engineers' offices, store house and electric station with switchboard and electrical instruments, and the anchorage site, served by many derricks and railroad tracks.

The electric current is received from the Pearl St. station of the Brooklyn Edison Co., by a direct feeder, a 1,000,000 c. m. National Conduit & Cable Co.'s concentric paper insulated cable. The feeder terminates at a centrally located switchboard on which are installed Thomson-Houston direct-current wattmeters for separate feeders supplying different classes of machinery. The feeders are arranged so that independent records can be made of the current furnished for the different kinds of work done.

Each of the 15 hoisting machines has a Johns-Manville service box designed to act as a switch and cutout. The fuses are removed by the operator whenever he leaves work and deposited with the storekeeper, thus preventing any possibility of the current being left on the machine when it is not in use and avoiding the danger of having the electric apparatus tampered with in the operator's absence. The hoisting machines are all of the Lidgerwood double-drum type with bull-wheel attachment. Each hoisting machine is equipped with a General Electric 52 motor and an R22 controller, which permits five different speeds.

There are two 6-in. Bush centrifugal pumps operated by General Electric 52 motors. They have worked day and night continuously for several months without any trouble or repairs. The three pile-drivers have Lidgerwood hoisting machines from which the bull wheel attachments have been removed, but will be replaced and the machines used on the traveler derricks after the pile driving is completed. Their service is especially economical on the pile drivers because nearly three-fourths of the time is spent waiting for the jetting, and during that period no power is wasted, as would be done in maintaining steam pressure ready for use at any moment.

About 8,000 ft. of standard gauge single track is laid in the yards and operated by a 240-volt current delivered by a third rail made with a naked 2-in. T-bar, covered at pleasure by a horizontal hinged board attached to a vertical bearing strip. Service on the track is maintained by three fifteen-ton steel motor cars and ten ten-ton steel trailer cars, all made by Wonham-Magor Engineering Works. Each motor car is equipped with two General Electric 60 motors and an R25 controller, the connections being arranged so that the motor can be used in series or parallel as occasion requires.

The contact shoes are of a simple, special pattern, devised by Mr. C. C. Harley, to suit the irregularities of the temporary tracks. The bottom piece is suspended by two vertical links with slotted holes engaging horizontal rods projecting from the vertical face of an oak board hinged to the car frame. Slight irregularities cause the shoe to slide up and down easily in the slots and serious obstructions throw up the hinged board and carry the shoe clear. The rails are carried on special insulators designed by Mr. Harley and the current is obtained from a General Electric 65 h.-p. motor-generator, with the motor end connected direct to the Edison system and the generator end to the railroad system. The installation of this system dispensed with a double contact system which would have been necessary if the current had been taken direct from the mains of the Edison system, because the neutral wire of the latter is grounded and thus prevented the use of the traction rail for a return. It also permits a more even regulation of the voltage.

The total electrical equipment comprises 541 h.-p., chiefly in 25 and 50 h.-p. units. There are fourteen No. 52, one No. 57 and six No. 60 series wound motors and five multipolar shunt-wound motors, all of the General Electric make, using 240 volts potential on the Edison three-wire system, besides fifty 5-ampere Adam-Bagnall enclosed arc lamps.

The records show that with a force of 125 men excavating and handling earth and driving piles, there was used in a 10-hour day shift 600 kilowatt hours, or 804 horse-power-hours, of current at a cost at the regular meter price of $22.11 for the entire plant. This includes current for 312 hoists of 1 cu. yd. of earth and 78 hoists of 4 cu. yd. each, equal to 624 single yard hoists of an average height of 20 ft. There were also three electric pile drivers working all the time; the constant operation of the centrifugal pump with a 6-in. discharge which raises the waste jet water about 25 ft. and the operation of the railroad, on which two 15-ton motor cars and two 10-ton trailers, each ran 92,000 ft. and back, fully loaded one way. In an average 10-hour night shift the current was 350 kilowatt-hours, or 469 horse-power-hours, at a cost of $12.89 including $2.66 for lights.

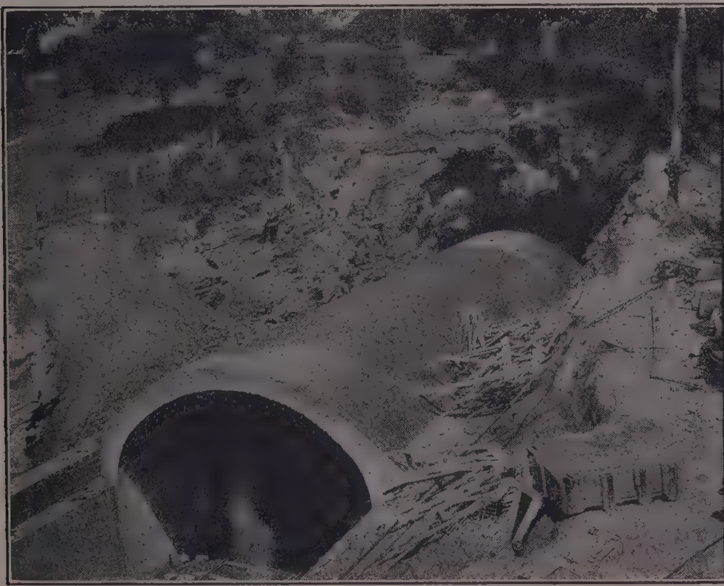
For the month of July the electric current for pile driving, excavating, pumping and other purposes, including transportation of earth and operation of unloading derricks, cost $600.26. Of this amount $208.54 was for pumping, $208.54 for hoisting and $104.27 for pile driving. The railroad current cost $211.97 and the electric lighting every night cost $37.75. In this month there was an average force of 160 men employed during the daytime and 72 men at night. During the night, excavating was not done, but there were seven motors used for the pile drivers and pumps. The earth excavated measured 8,530 cu. yd. and was handled in 22,619 hoists of an average of 20 ft. and 1,647 car-trips of about 2,300 ft. each over a maximum grade of 3 per cent.; 4,440 lin. ft. of 12 x 12-in. sheet piling and 7,540 lin. ft. of round piles were driven to an average depth of 40 ft. through extremely hard sand gravel and boulders by a 2,400-lb. hammer and a 150-lb hydraulic jet, the latter being operated three times as long to scour out a hole before the pile was driven as was required to drive the pile with the jet alongside, in the manner described in The Engineering Record of Aug. 12.

From these data it has been estimated by the contractors' engineers that the work is done by electric power at about 40 per cent. of the direct cost that would be required for steam power if generated by the contractor in a central plant on the work, and that the cost of installation and repairs for the electrical equipment is no greater than for the corresponding steam plant. Besides this considerable advantage is evident in the ability to turn on full power instantly and to apply it at any part of the work without moving heavy engines or the losses, delays and inconveniences incurred in carrying steam long distances.

The work is being done for the bridge department of New York, Mr. George E. Best comsioner, Mr. O. F. Nichols chief engineer, Mr. R. S. Buck consulting engineer, Mr. H. D. Robinson engineer in charge and Mr. D. E. Baxter resident engineer. The contractor is the Kosmos Engineering Co., Brooklyn, Mr. E. H. Baillie president, Mr. Gustave Kaufman chief engineer, and Mr. C. C. Harley electrical engineer.

Construction of the Pocahontas Tunnel New York Central R. R.

The Port Morris branch of the Harlem Division of the New York Central & Hudson River Railroad extends about 1¼ miles from Melrose station to the Port Morris docks on the Harlem River, and is now used for the transfer of coal from the pockets at the docks to the main line. It was constructed as a single track surface line following the contours around a rocky hill in St. Mary's Park, near the middle of its length. It was recently determined to depress and rectify the road and double-track it, and the contract for the entire work was awarded to The United Engineering & Contracting Co., of New York.



Tunnel with Reinforced Concrete Roof.

Centering for Concrete Arch Roof.

The line includes 600 ft. of driven tunnel, 600 ft. of arch roof tunnel built in open trench and backfilled, 400 ft. of flat roof tunnel, and about 5,000 ft. of open cut with retaining walls. There are eight street crossings over the open cut, all made with skew plate girders 30 in. deep and about 3 ft. apart, set on bridge seats, made by extensions of the retaining walls. The tracks were depressed an average of about 12 ft., the line was shortened about 300 ft. and about 90 degrees of curvature were eliminated. The principal quantities involved in the construction include 50,000 cu. yd. of earth excavation, 60,000 yd. of rock excavation, and 25,000 yd. of concrete masonry. Work was commenced March 1, 1903, and about 93 per cent. of it is now completed; the remainder includes some difficult crossings under the highway and elevated railway tracks and places where operations are delayed by water-mains in service which must be removed by the city.

All masonry is of concrete made with rock excavated on the work and Giant Portland cement in the proportion of 1:3:5 for the arch ring coping, and floor arches and 1:3:6 for side walls and most other construction. The depth of open cut varies and the height of the retaining walls is from 2 to 20 ft., with varying proportionate bottom thicknesses and a uniform top thickness. It was built in convenient sections, ordinary wooden moulds of the full height, concrete being delivered from the central plant in side dump cars on a standard gauge service track on top of the bank alongside, and handled by stiff-leg derricks at frequent intervals. The coping was made in separate moulds and is bonded to the wall concrete with vertical anchor bolts built into the wall. Vertical expansion joints are provided, and there are semi-circular refuge niches moulded in the retaining walls and tunnel walls.

The tunnel structure which was built in open cut, has vertical side walls, practically identical with the retaining walls in open cut, which support transverse plate girders. The spaces between the girder webs are filled with concrete arches, enclosing the lower flanges and levelled horizontal above the top flanges.

The driven tunnel has a concrete lining with vertical side walls. The semicircular roof arch is seated on the top of the wall as shown in the end view of a section of the tunnel, and is reinforced with Clinton wirecloth. The arch and the side walls of the tunnel are waterproofed by the Sicilian Asphalt Co. There is no concrete invert for either the tunnel or the open cut, excavation being made below rail level and filled in with rock ballast. In the center of the tunnel and of the open cut, a trench is excavated below subgrade and in it is laid a line of large glazed clay pipe carrying all drainage to the Harlem River.

Concrete Retaining Walls in Open Cut.

Power Plant and Concrete Mixer.

The maximum depth of excavation in open cut was 26 ft. and the material encountered was earth and sand overlying the rock, which outcropped in some places. The earth stood well in the cut, requiring sheeting or bracing at the northern end of the work only. The water encountered was removed by a Lawrence centrifugal pump, driven by an independent steam engine and boiler located at a sump near the lower end of the driven tunnel. Excavation in open cut was made by steamshovel in part and in part by hand, and the materials being loaded into 3 yd. and 6 yd. wooden, side dump Ryan & McDonald cars hauled by locomotives on the old line of railroad and on short extensions of it or sidings. For the rock excavation drilling was done by six Rand and 6 McKiernan drills operated by air from two Rand straight line compressors driven with steam from a battery of six 100-hp. boilers. The compressed air was also used for operating the steam shovel in the tunnel and for operating some of the hoisting engines on the derricks. There were ten stiff-leg derricks with booms from 40 to 60 ft. long and capacities of about 10 tons. They were equipped with Lidgerwood and Lambert engines fitted with swinging gear.

The tunnel excavation was wholly in rock and was made simultaneously from both portals with 8 x 12 ft. top headings and two benches, the upper one 4 ft. high. The rock was blasted with Jovite and with 60 per cent. dynamite, about equal quantities of each being used. Two tracks were laid in the tunnel close up to the bench. On one of them a Marion Model 20 steam shovel was installed and loaded the muck on the dump cars already mentioned, which were hauled out by an endless steel cable operated by a hoisting engine and bringing in the empty cars. Before each blast the steam shovel was pulled back about 100 ft. from the heading to be safe from flying stones. The rock was sound and required no roof timbering.

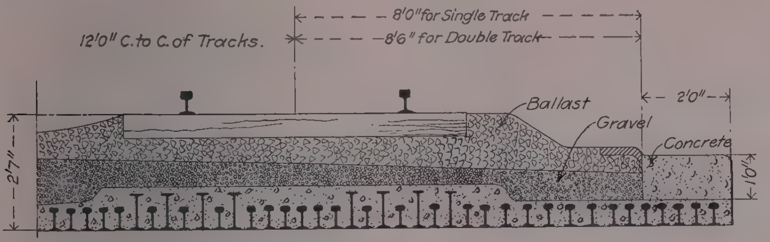
The moulds for the side walls were made in sections and were carried on the sides of a rolling tower which was advanced as the work progressed. The moulds had a horizontal adjustment of about 6 in. A timber trestle was built on the axis of the tunnel to the height of the skewbacks and on it was laid a track on which concrete was delivered in side dump 3-yd. cars, which deposited it through chutes into the moulds without lifting in the tunnel. The arch centering was supported on vertical posts on the sides and center line of the tunnel. The bents were set 30 in. apart and were provided with movable scarf boards to support the lagging, which was built up from the springing line as fast as the concrete was filled in. The concrete was delivered on the same elevated track as for the side walls and was shoveled direct from the cars to position. In most cases the roof excavation was made close to the finished lines of the tunnel section, but in some places where the rock was loose and was cut at an angle with the stratification a large space was left above the crown of the arch.

The rock spoil from the tunnel excavation from the north portal was dumped at a point about 200 ft. from the portal and about 3,000 ft. from the north end of the line, and here was located the power plant and the concrete mixer. Rock was crushed by two Gates machines on the surface of the ground. Each machine was driven by an independent steam engine using steam from the main boilers, and was run only about as fast as the stone was used for concrete. The stone was delivered from the crusher into a bucket elevator made by the Good Roads Machinery Co., and raised about 50 ft., screened and delivered by gravity to a hopper-bottom storage bin above the concrete mixing platform. The stone was passed through a 2-in. mesh, inclined screen and the pieces rejected were returned to the crusher. What passed the screen was run over a second screen of ¼-in. mesh, and the material passing through this screen was wasted. After the storage bin was filled any excess of crushed stone was delivered by a chute to a small steel dump car distributing it on a storage pile at the foot of the elevator, by which it could be again delivered to the bin when the latter was empty. Pit sand was delivered on the standard gauge surface track to the stone elevator which filled a storage bin adjacent to the stone bin. Cement in bags was delivered from cars on the track to a house with a storage capacity of about four carloads on a floor at the level of the mixing platform.

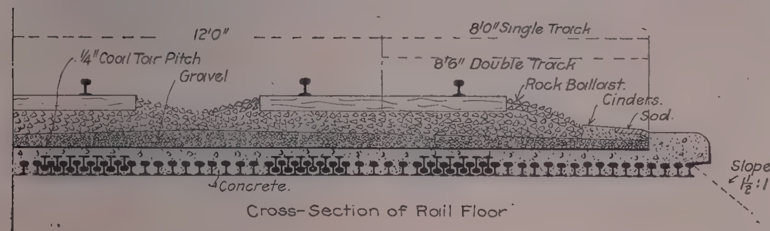
The stone and sand bin chutes delivered to the measuring hopper on the mixing floor. The lower end of each chute was open and was provided with a short section of wooden trough, hinged at one end and suspended at the other end. When this trough was pulled up into a horizontal position, it closed the chute, when the free end was lowered by the mixer man, it allowed the stone or sand to escape from the chute at a speed corresponding with the inclination of the chute. This arrangement was very simple and convenient, and allowed the materials to be handled accurately and rapidly. The measuring hopper had a capacity of 1¼ yd. and was made of wood with a V-shape cross section. It was divided by a vertical partition which gave one space proportioned for the required amount of sand and the other for the corresponding stone for one batch of concrete. One inclined side of the hopper had across the lower side a flap door hinged to a horizontal axis on the upper edge. This door was secured by a latch and operated by a long hand lever. When it was opened it discharged directly into a steel funnel engaging the opening of a Smith concrete mixer set at a level below the mixing floor. Bags of cement and buckets of water were thrown by hand into the funnel with the stone and sand and delivered to the machine. The machine was revolved constantly and its motion was not stopped when it was dumped by a worm gear operated by hand. The concrete was delivered from the machine directly to the cars which transported it to the tunnel or cut as required. The machine has a rated capacity of 300 cu. yd. in 10 hours, but as in most work this was limited by the ability to handle the concrete and 150 yd. in 10 hours was the best record made. The concrete was mixed very wet and care was taken in placing it to spade it well back from the face of the mould so as to work the stones out of sight and leave a very finegrained uniform, smooth surface, which presented an unusually handsome appearance in the finished structure. Movable steel plates were also used in some cases to separate face mortar from the body of the concrete placed at the same time. At the south end of the driven tunnel the portal is oblique to the axis and the concrete was coursed to represent ring stones with deep joints and presents a very attractive appearance.

Bridge Renewals on the West Shore R. R.

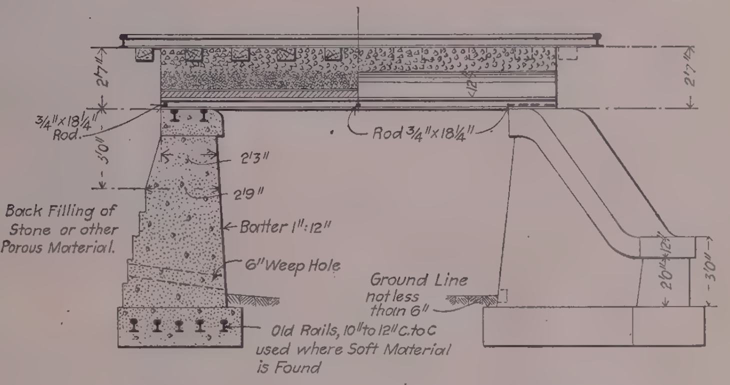
In accordance with the scheme for improvement of the West Shore division of the New York Central & Hudson R. R., which was described in The Engineering Record of July 16, 1904, all of the bridges on about 65 miles of single track and 120 miles of double track between Schenectady and Buffalo are now being renewed or reinforced. The new structures include about thirty spans of 50 ft. and under, about 40 new through plate girder spans from 30 ft. to 110 ft. long, two pin-connected 201-ft. spans, three lattice girder spans crossing the Erie canal, five 125-ft. to 170-ft. fixed truss spans, one 96 ft. counterbalanced vertical lift bridge of special design with electrically operated mechanism across the Oswego canal at Syracuse, one 40-ft. concrete arch span about 40 ft. high from natural ground to base of rail, for a watercourse in the middle of an existing viaduct which will be replaced with a solid embankment and about 25 short span concrete arches, rail floors and pipe conduits for culverts, etc., which will replace present wooden stringers and girder bridges.



Cross-Section of I-Beam and Rail Floor.



Cross-Section of Rail Floor


2'7"
2'7"
12"
¾"x18¼" Rod.
Rod ¾"x18¼"
3'0"
2'3"
2'9"
Back Filling of Stone or other Porous Material.
Batter 1":12"
6" Weep Hole
Ground Line not less than 6"
12"
2'0"
3'0"
Old Rails, 10" to 12" C. to C used where Soft Material is Found

Half Cross-Section. Half End Elevation.

Standard Steel and Concrete Spans of West Shore Division, New York Central Lines.

In Schoharie creek, at Fort Hunter, new concrete piers will be built with open cofferdams in water about 14 ft. deep. In most other places the old masonry substructures will be used and will be repaired with concrete when necessary. A few old deck spans of less than 80 ft. have lattice girders, but most of them have deck plate girders. In both cases the existing girders will be doubled so as to place two girders under each rail, and new single girders, or other old single or double girders will be added to carry the other rails.

Up to 12 ft. span low culverts and cattle passes are made with steel rails bedded in 1:2:3 concrete made with Portland cement and fine crushed stone or gravel. The upper surface is covered with ¼-in. American straight run coal tar pitch, above which the stone ballast is filled in, as shown in cross section. The abutments are made with 1:3:6 concrete offset on the rear face and battered 1:12 on the front face. The coping is made with 1:1:2 concrete and is reinforced with two transverse rails bedded in the upper part. In soft ground the 1:4:7½ concrete is reinforced with one layer of transverse rails 12 in. apart. Where it is necessary to splice the reinforcement rails the joints are staggered and each is spliced with two bolted angle bars. The rails in the floor platform are thoroughly cleaned and are painted one coat of red lead and oil, one coat of bridge paint before being concreted. The number of rails used in the different portions of the cross-section varies according to the length of the spans and the widths of the rails and in the group directly under tie the ranges from twenty-four 60-lb. rail per 4-ft. span to forty-six 60-lb. rails for an 11-ft. span and from eighteen 100-lb. rails for a 4-ft. span to twenty-four 100-lb. rails for a 12-ft. span.

For spans of from 12 to 16 ft. between copings an alternative design is used with a single tier of rails combined with I-beams grouped under the track rails, as indicated in the cross-section, which shows the construction for both single and double tracks. In this design the rails are arranged as close together as they can be placed and their number does not vary. The size and number of the I-beams under each rail varies from four 8-in., 65-lb. beams for a 4-ft. span to eight 8-in., 65-lb. beams for a 9-ft. span, and from one 15-in., 200-lb. beam for a 4-ft. to three 15-ft., 200-lb. beams for a 16-ft. span. For a 9-ft. span six 9-in., 70-lb. beams are used, for an 11-ft. span seven 9-in., 87-lb. beams, for a 13-ft. span seven 10-in., 95-lb. beams, for a 14-ft. span seven 10½-in., 105-lb. beams, and for a 15-ft. span six 12-in., 125-lb. beams.

A third type of short spans which is standard with the New York Central lines consists of groups of I-beams under each rail with continu- covered with 1½ in. to 4 in. of binder, on which ous flat deck plates riveted to their top flanges and the stone ballast is laid. This type is not, however, used for the bridges now being built on the West Shore division.

For each plate-girder bridge there is issued to the contractor a small blue-print with diagrams of the plan and elevation of the bridge, giving important data and necessary information from which the structure can be detailed in accordance with the standard printed specifications issued by the engineering department. These specifications provide that the depth of the girder shall be generally not less than one-tenth of its span and never less than one-twelfth of the span. In cases where these proportions are not possible, sufficient material must be used to reduce the deflection to that which would occur in a girder with a depth of one-twelfth of its span.

The angles are required to form as large a part of the flange section as possible, and the flange cover plates are of uniform thickness, or diminish in thickness outward from the angles. The first cover plate extends the full length of the girder except when this is less than 75 ft. All girders have web stiffener angles at the ends and at any points of concentrated loads and all stiffener angles have fillers. The floor beams in short spans are connected to the girders with gusset plates which are integral with the webs of the floor beams and are stiffened by pairs of inclined flange angles. Girders 75 ft. or more in length have pin or rocker bearings and expansion rollers. Deck plate girder spans less than 75 ft. long are shop-riveted up complete. The upper corners of deep through girders are rounded except where the ends of two girders of the same depth are adjacent.

Two types of through span solid floors are shown; one of them consists of transverse I-beams riveted to the girder webs flush with the lower flanges and covered with a continuous horizontal plate riveted to their top flanges. The other consists of rectangular transverse troughs formerly built of plates and angles but now usually made with channels and riveted with vertical connection angles to the girder webs. Both floors are covered with ballast on which the track is laid.

All the bridges for the work here described are being built by the Riter-Conley Manufacturing Co. on a contract for 11,000 tons of bridge work, the delivery of which has now commenced and is to be completed by Jan. 1, 1906. Most of the bridges will be erected by the railroad company's employees. Truss spans will be assembled on falsework and girder spans will be generally erected by special derrick cars. The work is being conducted by the engineering department of the railroad, Mr. H. Fernstrom, chief engineer, and Mr. A. W. Carpenter, engineer of bridges, reporting to Mr. G. W. Vaughan, engineer of maintenance of way.

Mechanical Draft has an advantage well shown at the Findlay power station of the Toledo, Bowling Green & Southern Ry. Owing to quicksand and bad bottom, it would have been necessary to pile the foundations for a self-supporting 175-ft. brick stack, bringing the whole cost to $10,000. A mechanical draft equipment was less expensive, owing largely to the much smaller cost for foundations in this case.

A Novel Electric Traveling Crane.

An electrically operated, standard gauge, locomotive revolving crane of a novel and distinct type is in use at the yards of the Link-Belt Engineering Co., Nicetown, Philadelphia, for loading and unloading cars, handling structural material and heavy castings, and for the miscellaneous work incident to the manufacture of conveying machinery . It will handle 6,000 lb. at 35 ft. radius, or 20,000 lb. at 15 ft. radius. The general appearance and compact design are shown by the accompanying illustration. The general dimensions are: Track gauge, 4 ft. 8½ in.; wheel base, 7 ft.; greatest width, 10 ft. 3 in.; radius of back end of upper frame, 10 ft. 9 in.; maximum working radius, 40 ft.; minimum working radius, 15 ft.; traveling speed per minute, 300 ft.

Severe tests have demonstrated the reliability of the crane under actual working conditions through all of the ranges of loading from that imposed by carrying a 1-ton bucket at 30 ft. radius, to that existing with the boom peeked up to 15 ft. radius with no load. There is a moment of stability to resist overturning forward under the worst conditions of 430,000 foot-pounds, and a moment of stability to resist overturning backward under the worst conditions of 55,000 foot-pounds. These moments are equivalent to an upward force applied to the rail in each case of a load of 86,000 pounds and 11,000 pounds, respectively.

The crane is equipped with double drums for operating a self-filling bucket, and is unique in that a separate motor is provided for hoisting, traveling and swinging. These motors are of the street-railway type and are of 70, 50 and 30 hp., respectively, for the different motions.

In the actual construction of the crane and arrangement of levers the functions of the control of the motors for hoisting and swinging are combined in one foot lever. The ordinary drum type of controller is entirely dispensed with, the crane being equipped throughout with General Electric type C plunker controllers, in which the master controller, which is operated by hand or foot of the operator, controls a small pilot current. This, operating through several solenoid magnets, cuts out several groups of resistances, so as to eventually throw the full voltage of the line on the motor so controlled. This action cannot take place except at a pre-determined rate of speed, in spite of the fact that the operator in starting up any of the motors can instantly push the controller pedal down to its full swing. As soon as the pedal is relieved of pressure from the foot of the operator it immediately assumes its normal position, throwing current off both motors. It will be seen that the machine is practically fool-proof, as far as any damage to the motors is concerned, through heavy starting currents.

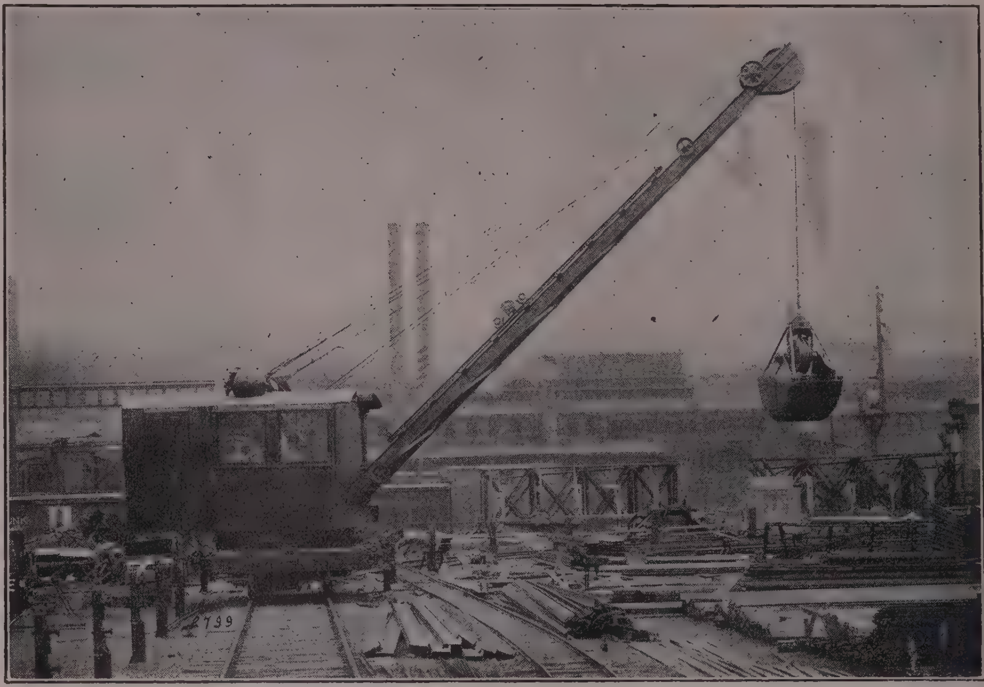
The master controller for operating the motor which propels the crane along its tracks is located conveniently for actuation by the hand of the operator.

Both hoisting and holding drums are provided with means for storing about 30 ft. of rope within the drum itself, the object of this being that as the short length of rope immediately connected to the bucket wears out some of the stored rope on the different drums may be unreeved so as to keep the lines of the original length, without it being necessary to scrap the ropes after the first break near the bucket.

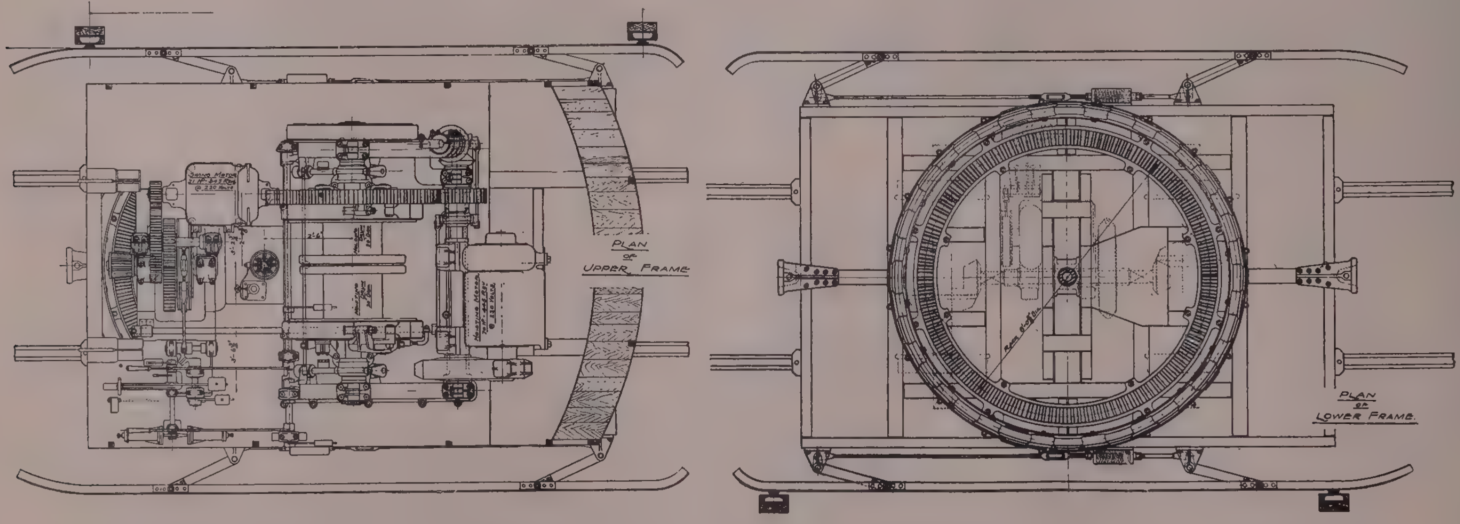
The crane is equipped with an automatic brake to insure the load against falling, through the interruption of the electric current or other cause, and is so arranged that as soon as the motor is brought to rest and the load attempts to overhaul the drum shaft the brake is automatically applied, making it almost impossible, under ordinary conditions, for the drum shaft to revolve in the direction necessary to lower the load. Being automatic, the brake requires no attention from the operator.

The most striking feature of the crane is the means employed for collecting the electric current. Posts are located alongside the track at intervals of 16 ft. Each post carries a positive and negative pad connected with the shop circuit. The lower frame of the crane is equipped with two parallel bars on each side, which are set out by means of a spring and parallel motion, and are of sufficient length to remain always in contact with the pads on at least one post. The great advantage of this feature may be best instanced by comparing it with the trolley-pole type of collector, where it is necessary to have the wires 40 ft. above the ground, an impracticable arrangement. The objection to the under-ground conduit system because of the difficulty in keeping the conductors dry, as well as the expense of construction, is an equally potent argument in favor of the method adopted. This system provides, with ordinary precautions, against accidents due to short circuits, etc.

The installation shows the advantages of a locomotive revolving crane, because the whole area is commanded by a comparatively small machine, requiring no supplementary construction; all foundation work, together with columns and over-head girders, are dispensed with, and the yard left free for the movement of bulky machin-



Electric Traveling Crane Taking Current from Contact Posts.



Deck and Turntable Plans of Electric Traveling Crane.

ery and structural material of any length.

The general arrangement is a Dodge Coal Storage Co. design, supplemented in the electrical equipment by Dodge & Day as consulting engineers.

Book Notes.

The pamphlet containing the report of the Committee on Standard Specifications for Cement of the American Society for Testing Materials, the progress report of the Am. Soc. C. E. Committee on Uniform Tests of Cement and other related reports, is now distributed by Prof. Edgar Marburg, Univ. of Pa., Philadelphia.

The Society for the Encouragement of French Industries, aided by the six principal railway companies of France, has published in a 500-page quarto a reprint of the most important papers on the brittleness of steel written in the last seventeen years in that country. This subject has received far more attention in France than elsewhere, and the volume is correspondingly valuable. The full title is "Contribution a l'Etude de la Fragilité dans les Fers et les Aciers."

The third edition of Prof. J. J. Thomson's "Elements of the Mathematical Theory of Electricity and Magnetism" contains one new chapter, in which is outlined his famous analysis of the properties of moving electric charges. This work has led to those theories of the nature of matter which have been attracting so much attention lately. The book is too well known to need review. It is enough to say that it is a scholarly work for real students. (Cambridge, Eng., The University Press, 10s.)

Another well-known book that has come out in a new edition is the "Textbook of Applied Mechanics and Mechanical Engineering," by Prof. Andrew Jamieson. The fourth edition of the second volume takes up motion and energy, graphic statics and its applications, the strength of materials, and hydraulics. The work is decidedly practical in the selection of illustrations and examples, but it is also free from the verbiage and lack of precision of "popular" books. The new material in this edition is collected in an appendix of considerable size. The book is particularly interesting to American readers because it is essentially the manual which indicates the scope of the information required to pass successfully the examinations of the Institution of Civil Engineers. Many of the problems are taken from the examination papers of that society, and it would be most interesting to know how well a good many engineers of large practice could solve them. (London, Chas. Griffin & Co., 12s. 6d.)

The National Board of Fire Underwriters has issued the 1905 edition of its "Rules and Requirements for the Installation of Electric Wiring and Apparatus." It is a well-indexed book of 139 pages giving those suggestions concerning electrical line work in buildings and the installation of apparatus which the Underwriters' National Electric Association consider to have any effect whatever on the fire hazard due to such work. Those who are acquainted with the investigations of the National Fire Protection Association know that a very accurate examination is made of the causes of fires that seem in any way due to defective electric wiring or apparatus, and that the data on this subject which are available for the insurance experts are of great number and variety. The code of rules has been modified from time to time in the light of the knowledge gained from the study of these data, and it has been made more stringent in various ways than the original requirements drawn up in 1897 by a commission representing various national engineering, architectural and insurance interests. This increased severity of the code is now strongly opposed by some electrical contractors, and it is not unlikely that an organized attack on it will shortly be made. The present form of the rules and regulations accordingly deserves a particularly careful study at this time.

About six years ago the U. S. Geological Survey published a report by Mr. George W. Rafter on the water resources of New York. This was necessarily a very much condensed discussion of the subject, and the author was accordingly requested by the State Geologist to prepare a complete report on the same topic, to form a part of the geological records of the State. This has just been published as a 900-page octavo volume, entitled "Hydrology of the State of New York." The author was able to use in its compilation not only all the published data of the State and national surveys, the State Engineer's office and similar sources, but also the great mass of information collected by him in private practice and while investigating the water supply for an enlarged canal system for the U. S. Deep Waterways Commission. The result is probably the most complete study of the water resources of any State that has ever appeared, with the possible exception of that of New Jersey. Mr. Rafter discusses many of the details at great length, and on this account it is somewhat difficult at times to see all the subject in a true perspective, but as he warns the reader of this feature of the book in its preface, it can hardly be considered a defect. In fact, it is safe to say that engineers called upon to examine power and water supply problems will find in this detail one of the leading merits of the book. Particular attention may be called to the chapters on the relation of rainfall to runoff, on runoff, and on the effect of forests, subjects to which the author has paid much attention for many years and has examined under very favorable circumstances. (New York State Museum, Albany, $1.50.)

The rapidly growing interest in the sand-lime brick industry lends special timeliness to Mr. E. Stöffler's "Mattoni e Pietre di Sabbia e Calce." The author outlines first the chemical problems that arise in this industry, and then takes up the principal machines employed in Central European plants. He next discusses the financial features of the industry, the cost of manufacture, the consumption of materials, and the amount of labor needed. Finally the various tests of sand-lime brick are explained and the apparatus used in making them described. Four large folding plates of plants of several sizes illustrate the general type of construction which the author considers best suited for the highest economy in production. The book is published at 3 lire by Ulrico Hoepli, Milan, Italy. The same publisher has brought out a manual of locomotive construction and maintenance by Mr. G. Ottone, under the title "Trazione a Vapore sulle Ferrovie Ordinarie." The Italian railways are largely under government direction, and it has been a frequent observation of railway officials of other countries that the motive power equipment of the lines is kept in a surprisingly high state of efficiency compared with the passenger cars. The locomotives are built to a considerable extent in Swiss and German shops, and in their general features seem to be a sort of compromise between French and German types. This is not brought out in the book mentioned, however, except in some of the minor comments made by the author, for the text is pretty well confined to a somewhat elementary discussion of the parts of a locomotive, somewhat of the same character as that in the well-known "Catechism" by Col. Forney. To American railway men the most interesting feature is the appendix giving the official Italian rules governing the maintenance and running of locomotives. The book is published at 4.50 lire.

Letters to the Editors.

Bascule Counterweights.

Sir: Referring to the letter of Mr. John Hawkesworth in your issue of July 29th, I beg to call attention to the fact that the compensating counterweight device, which he applied to his gate and which he believes would revolutionize bascule-bridge building, is one of the earliest forms of counterweights used for bascule bridges. By reference to the "Railroad Gazette" of June 10, 1892, Mr. Hawkesworth will find a very good example of this type of bascule bridge built by the N. Y. C. & H. R. R R Co. over the Harlem River. There are still earlier examples of this and other types of compensating counterweight, such as the spiral drum, the chain, etc., but in recent years the tendency has been away from such devices and toward constructions of a more positive nature and less liable to derangement. As regards tail pits and special work there are designs now in use which have successfully overcome these objections.

Very truly yours J. B. Strauss.
Chicago, Aug. 9.

Superheated Steam.

Sir: In your issue of July 8th, under the title: "The Folly of Broad Claims for Highly Superheated Steam," you commented editorially on the test of a 500-hp., vertical, cross-compound mill engine at Belfast, and protested quite vigorously against the doings of wicked superheater manufacturers who support their claims for great economy in high superheat by exhibiting one side of the balance sheet only. You certainly serve a useful purpose in trying to emphasize the facts relating to such an important matter as this. But after reading the articles more than once, I am inclined to believe that you may have leaned back rather too far and have left the laymen with an impression not only unfavorable to the use of highly superheated steam, but possibly to the general subject of superheating even to a moderate degree, which, without exaggeration, may be said to have become almost universal practice in modern steam power plants.

In order to give the Belfast test its due, the facts should be brought out that the clearances were comparatively large, being 8.7 per cent. for the high and 9.4 per cent. for the low-pressure cylinder, which condition would increase the steam consumption, also that the cylinders were not jacketed, which greatly simplifies the construction.

In getting at the cost of the superheat you treat the subject as being a general one by the analysis of a particular method. Even though your estimates were correct as to the waste of heat by using a separately-fired superheater, it does not follow that the combination of the superheater with the boiler will not give the desired temperature with very high efficiency.

The British thermal units consumed per minute per horsepower furnished a good basis for comparison of engine economies, and we find in the Belfast test this unjacketed engine at approximately a full load consumed 198.25 B.t.u. per minute per indicated horsepower, using highly superheated steam, whereas a jacketed up-to-date Rice & Sargent engine at the plant of the American Sugar Refining Co., Brooklyn, was shown by Professor Jacobus on a recent test to give 231.8 B.t.u. per hour per indicated horse-power, using saturated steam and working at full load. The saturated steam engine has, therefore, consumed 16.9 per cent. more heat than the superheated steam engine, notwithstanding the jackets, separators, etc., which have been added to prevent waste of heat.

This is a much more favorable showing for highly superheated steam than your article admits. But the few instances when high superheat is used as compared with the very general adoption of moderate superheat, offer a pretty strong proof of the advantages of the latter system. A fair estimate of the horse-power of superheaters constructed in this country during the past two or three years would be about 600,000 horse-power at 30 lb. steam per hour per horse-power, and 500° Fahr. would appear to be the most favored temperature for steam for general use.

Yours truly, The Power Specialty Co.,
New York, Aug. 17. E. H. Foster.

Horse-Power of Streams.

Sir: The paper on "Formulas and Computations for Horse-Power Value of Streams," by W. L. Church, of Boston, Mass., in yours of July 1, 1905, is useful and interesting. In common with many others, however, he assumes that it is desirable to use the rainfall at the nearest point where the rainfall has been observed and apply it to percentages of run-off ascertained at the nearest point where these percentages have been observed for a long term of years. While this appears logical enough at first thought, it is very liable to give erratic results by months. This is seen in Mr. Church's illustration, where he combines a 4-in. May rainfall with an unusually large May percentage of run-off, which gives a phenomenal result. As Mr. Church lives in Boston and uses the Croton run-off, it is to be presumed that his specific case is in New York or New England, where a May flow twice as great as any other month in the year and nearly three times as great as that of March in the same year is so unusual, if not unprecedented, that it makes one doubt the advisability of using the method suggested by Mr. Church.

It has long seemed to the writer that the actual flows of a number of New York and New England streams were a much safer guide in determining the probable flow of other New York and New England streams than the product of rainfall in a neighboring or even the same town, multiplied by the percentage of run-off in another town. It should be borne in mind that the flow of all streams in the section of country mentioned that are large enough to be developed for water power is much more uniform than either the rainfall or percentage of run-off taken monthly.

The flow of a stream having a drainage area of 371 square miles in any given summer month may depend nearly as much on the rainfall of preceding months as the rainfall of the month in which the flow is measured. A month without rain might occur and the percentage of run-off would be infinite or, what is more to the purpose, a very light rainfall will appear to give a very large percentage of run-off provided the rainfall has been abundant in previous months.

When the minimum flow for a single month in the Croton, Connecticut and Merrimac Rivers is from 0.2 to 0.3 cu. ft. per second per square mile, it seems more than drastic to suggest a method which indicates that 371 square miles with 227 ft. working head might give as little as 272 hp. in the dryest month of the driest year. One might as well use the recent Sudbury run-off of zero or less and thus indicate no flow for a month.

Yours respectfully,
C. E. Chandler.
Norwich, Conn., Aug. 15.

Stresses in a Mill Column.

Sir: I shall esteem it a favor if you will kindly state what are the greatest actual stresses in the lower part of the building columns, shown in the attached drawing, where these stresses occur, and also what are the greatest stresses under the conditions given, and with the swing-crane swung under the traveling crane. Kindly give all formulas or calculations in full and also references to standard works. Thanking you in advance, I remain,

Yours very truly, Enquirer-Subscriber.

The Engineering Record does not ordinarily give space to such enquiries, but as this is a problem of special interest, it requested Dr. Myron S. Falk to outline a practical solution; his answer is as follows:

"The problem furnished by Enquirer-Subscriber may be simplified without incurring material error, by substituting the following conditions for those of the actual structure. The smaller truss members of the swing crane may be considered replaced by a strut from the foot of the column to the point of application of the 6,000-lb. load, so that the member *BC* is no longer stressed in flexure by the weight of 6,000 lb. hanging at *B*. The post is then subjected to the following externally-applied forces:

1. The direct vertical load at *D* of about 20,000 lb.

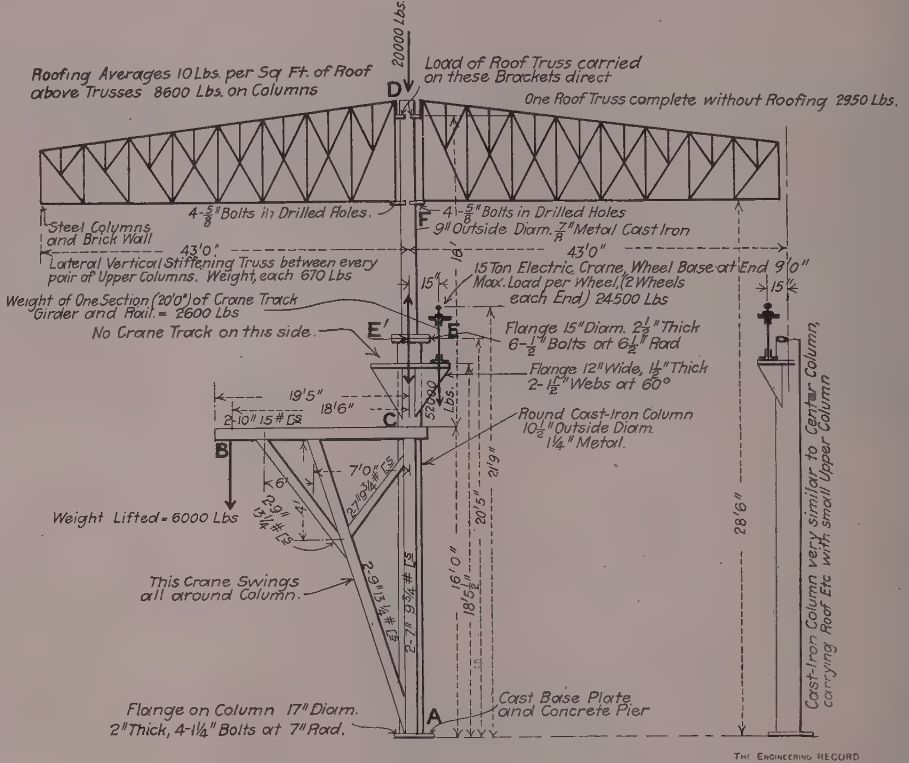
2. The loading of about 52,000 lb. carried on the bracket at *E* and acting at a distance of 15 ins. from the center line of the column.

3. The horizontal force of about 7,000 lb. acting at *C* and found by resolving the vertical load of 6,000 lb., hanging at *B*, into its proper components.

It is impossible to determine exactly the condition of fixedness of the ends of the column at *A* and *D* or *F*; it is probable that some partial degree of fixedness at all these points exists. It will be sufficiently accurate to consider the column as fully fixed at *A* and also at a point 16 ft. above *C*, the latter point being then half way between. The problem might also be treated by considering the column as hinged at both *A* and *F*.

The loading at *E* may be treated in combination with two equal and opposite imaginary forces acting in the center line E^1 of the column. The combination of one of these forces with the actual load of 52,000 lb., furnishes a couple with a moment of 52,000 × 15 = 780,000 inch-pounds; the other force causes a direct compression in the column of 52,000 lb.

The bending in the column caused by the tension in the horizontal arm of the swing crane is found as for any beam since the stress in *BC* acts as a load of 7,000 lb. at the center of a beam whose span length is the height of the column, 32 ft. Since the ends of this column have been assumed fixed, the maximum value of the moment may be expressed by $W l \div 8$, where l is the span length, and W is the load of 7,000 lb. Assuming the swing crane as swung to the right, this bending moment will cause a compression at the foot of the post on its right side, and a similar amount of tension on the same side of the post at the point of application of the load.


20000 Lbs.
Roofing Averages 10 Lbs. per Sq. Ft. of Roof above Trusses 8600 Lbs. on Columns
D
Load of Roof Truss carried on these Brackets direct
One Roof Truss complete without Roofing 2950 Lbs.
4-5/8" Bolts in Drilled Holes.
Steel Columns and Brick Wall
F
4-5/8" Bolts in Drilled Holes
9" Outside Diam. 7/8" Metal Cast Iron
43'0"
43'0"
Lateral Vertical Stiffening Truss between every pair of Upper Columns. Weight, each 670 Lbs
16'
15"
15 Ton Electric Crane, Wheel Base at End 9'0"
Max. Load per Wheel, (2 Wheels each End) 24500 Lbs
15"
Weight of One Section (20'0") of Crane Track Girder and Rail. = 2600 Lbs
No Crane Track on this side.
E'
E
Flange 15" Diam. 2 1/2" Thick 6-1/2" Bolts at 6 1/2" Rad
Flange 12" Wide, 1 1/2" Thick 2-1 1/2" Webs at 60°
19'5"
18'6"
2-10" 15# [s
C
52000 Lbs.
Round Cast-Iron Column 10 1/2" Outside Diam. 1 1/4" Metal.
B
7'0"
2-7" 9 3/4# [s
6'
4'
2-9" 13 1/4# [s
Weight Lifted = 6000 Lbs
21'9"
20'5"
18'5 1/2"
16'0"
28'6"
2-9" 13 1/4# [s
2-7" 9 3/4# [s
This Crane Swings all around Column.
Cast-Iron Column very similar to Center Column, carrying Roof Etc with small Upper Column
Flange on Column 17" Diam. 2" Thick, 4-1 1/4" Bolts at 7" Rad.
A
Cast Base Plate and Concrete Pier
The Engineering Record

General Details of Special Column of Mill Building.

The moment (uniform throughout the post) caused by the traveling crane furnishes compression on the right side of the post. The maximum compression stress at the foot of the post is therefore found by combining the two moments, viz.: 780,000 + (7,000 × 12 × 32) ÷ 8 = 1,116,000 inch-pounds, the stress caused by this moment being found by the usual formula $M = K I \div d$, K being the intensity of the stress in the extreme fibre at the distance d from the neutral axis, and I the moment of inertia of the cross-section of the column.

In the problem, the column is of cast iron, 10½ in. in outside diameter, with 1¼ in. thickness of metal; $d = 5\frac{1}{4}$ in., and $I = 207$ approximately. Consequently $K = (1{,}116{,}000 \times 5.25) \div 207 = 28{,}300$ pounds per square inch.

To this compressive intensity there must still be added the direct compressive stress in the column. The value of the greatest tensile intensity of stress will be 28,300 lb. less the direct-compressive stress in the column.

The preceding method of analysis is approximate, but will in general furnish sufficiently accurate results. For a detailed and exact analysis of this character of problem reference should be made to Wm. H. Burr's "Resistance of Materials," edition 1903, page 189.

CURRENT NEWS SUPPLEMENT

AUGUST 26, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers, Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Boston, Sept. 25-29.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

AMERICAN PUBLIC HEALTH ASSOCIATION.

The thirty-third annual meeting of the American Public Health Association will be held at Boston for five days beginning Sept. 25. The arrangements are in charge of a local committee, of which Dr. H. P. Walcott, of Cambridge, is chairman. The program as now laid down has eleven subjects, the methods of securing more uniform instruction and co-operation in health work, various topics relating to water supply, tropical hygiene, disease common to man and animals, military hygiene, quarantine methods, recent researches in smallpox, modes of dissemination and rational quarantine in epidemic cerebro-spinal meningitis, disinfection, sewage and waste disposal, and car sanitation.

CENTRAL STATES WATER-WORKS ASSOCIATION

The ninth annual convention of the Central States Water-Works Association will be held in Columbus on Sept. 12-14, at the same time as the meetings of the Boards of Public Service of Ohio and the Fire Chiefs' Association. The headquarters will be in the Great Southern Hotel, and it is announced that papers of more than ordinary interest will be read. The excursions are particularly attractive, for they will give the members of the association an opportunity of inspecting the work on the new storage dam, the water purifying and softening plant, and the sewage works which are now under construction.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

A provisional programme of the convention of this society at Montreal next month has been issued, and the schedule of papers so far as it has been arranged is as follows:

September 5.—Afternoon meeting: Report of committee on municipal data and statistics, by Wm. Fortune; report of committee on municipal franchises, by James Owen.

Evening Meeting: "The Theory and Practice of Assessments for Local Improvements," by Nelson P. Lewis; "The Legislative Functions of Greater New York," by Milo R. Maltbie; "Legislative Functions Under the White Charter, and the Practical Effects of the Latter Upon Municipal Government," by Thomas J. Neville; "Trend of Park Progress," by G. A. Parker; "A Review of Municipal Work in the Atlantic Coast States," by T. Chalkley Hatton; "A Review of Municipal Work in the Rest of the United States," by Charles C. Brown; "A Review of Municipal Work in Canada," by N. J. Ker.

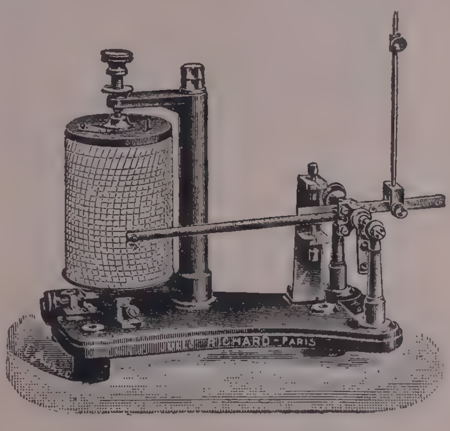
September 6.—Evening Meeting: Report of Committee on Street Paving, by C. D. Pollock; "Gutters and Cross-Walks for Macadam Pavements," by W. J. Stewart; "The Organization and Conduct of a Bureau of Street Repairs for a City of 1,250,000 Population," by Edwin J. Fort; "Paving Materials—the Importance of a Preliminary Test," by Maj. J. W. Howard; "Cost of Collection and Disposal of Garbage," by B. E. Briggs; "Garbage Disposal Plants in the United States," by Dr. James Bayles: "Electric Lighting, with Special Reference to Underground Construction," by E. A. Fisher. Papers on the effect of water on asphalt, the development of the road roller, and the use of oil on macadam roads are also expected for this meeting.

September 7.—Morning Meeting: Papers by city officials of Montreal.

Evening Meeting: "A review of the Anti-Mosquito Campaign, with Special Reference to the Work in New Jersey," by Edward S. Rankin; "A Standard for Disinfectants," by Wm. S. Crandall; "Sanitary Engineering in the Southern States," by J. W. Hazlehurst; "Sewage Disposal, an Experiment and an Experience," by W. H. V. Reimer.

THE RICHARD BRIDGE DEFLECTOMETER.

The deflectometers designed by Prof. Rabut of the Ecole des Ponts et Chaussees at Paris are probably known to a number of the readers of this journal who have followed bridge testing in France. These instruments are made by Jules Richard, of Paris, now represented in the United States by Ernest H. Du Vivier, 14 Church St., New York, who is arranging to distribute Richard apparatus in this country.



RICHARD'S BRIDGE DEFLECTOMETER.

The bridge deflectometer consists primarily of a lever pivoted on a horizontal axis. To the short arm of the lever is attached the rod or wire which communicates the vibrations of the bridge to the instrument. The end of the long arm carries a pen which traces a curve on a suitably lined sheet of paper attached to a recording drum rotating uniformly around a vertical axis. The short arm of the lever is fitted with four steel bearings to which the rod from the bridge may be attached so as to cause the record to be 20, 10, 5 or 2½ times the actual deflection. All joints are made so as to work without appreciable play or friction, and the movable parts are very light to avoid errors due to inertia.

If desired the instrument will be furnished with a second lever similar to the first but at an angle of 90 deg. with it, which will record horizontal deflections.

The instrument is furnished with two interchangeable cylinders, one revolving in 13 minutes and the other in 26 seconds. Cylinders revolving much more slowly can be supplied if desired. The instrument is made more complete by the use of an electric chronograph, which serves to mark the important periods of the experiments. It is put in circuit with two Leclanche cells and a key. By closing the latter the pen makes a short stroke at the edge of the chart.

It should also be stated that the extensometer designed by Director Mesnager of the laboratory of the Ecole des Ponts et Chaussees is also made by Mr. Richard. The model usually preferred amplifies 1500 times the motion in a 4-in. section of a bridge member or similar object.

A HEAVY DUTY AIR COMPRESSOR.

The Calumet & Arizona Mining Co., of Bisbee, Ariz., is installing a Sullivan Corliss cross-compound steam two-stage air compressor, with a total piston displacement of 3660 cu. ft., which, on account of the altitude at which the compressor operates, is equivalent to an actual delivered capacity of 2700 cu. ft. of free air per minute against a terminal pressure of 100 lb. per square inch, while running at 83 r.p.m. This machine is expected to attain a very high efficiency, being designed to run condensing and to operate when carrying its most economical load on 15.2 lb. of dry steam per indicated horsepower per hour.

The steam cylinders are 17 and 34 in. and air cylinders 20 and 34 in. in diameter, with a common stroke of 42 in. Rolling inlet valves controlled by independent eccentrics are used on both the high and low-pressure air cylinders. Rolling discharge valves are also used on the low-pressure air cylinder. In addition to these, a number of automatic poppet discharge valves are used on the same cylinder. The high-pressure air cylinder is equipped with a full set of removable automatic poppet discharge valves, which act in a direction parallel with the steam piston rod. An interesting feature is the automatic oiling system, which lubricates all the working parts regularly and without the attention of the engineer. The machine will be used for operating rock drills and other pneumatic tools about the mines.

THE BUSH WAREHOUSE AND FACTORY IMPROVEMENTS.

One of the most important private enterprises in New York harbor is the system of improvements undertaken by the Bush Terminal Co. This company owns thirty blocks of property along the South Brooklyn shore, where it has already constructed the five largest piers in this port, each 1400 ft. long and 150 ft. wide, and a system of more than fifty warehouses. It acts as terminal agent of all the trunk lines entering New York, with the present exception of the Pennsylvania R. R., which maintains its own terminal a few blocks distant, at the foot of 6th St., to which point the Bush Terminal R. R. is now being built to connect the two terminals. This line will be completed in the fall.

The Bush Terminal Co. has begun the development of a factory and shipping community back of this terminal plant, and it purposes creating a series of modern buildings for the use of manufacturers or wholesale houses desiring a location in Greater New York, within easy reach of the business center where maximum shipping facilities may be obtained at a minimum cost. It is already constructing the first of these buildings and will also construct for responsible tenants buildings designed to meet their particular needs, providing such construction does not take a form which could not be adapted to other purposes than those of the first tenant. The advantages offered are as follows:

First—Direct track connection with a terminal agent acting for the trunk lines, by which means shipments to and from the factory may be made in any sized lot at regular New York rates, thus eliminating all cartage upon rail shipments.

Second—A harbor lighterage service connecting with all the steamship and steamboat lines docking in New York harbor. The lighterage service includes the handling of small as well as carload shipments at moderate rates, and in many cases, where the terminal costs are absorbed by the steamboat or steamship companies, free of charge.

Third—Absolutely fireproof buildings equipped with an automatic sprinkler system of fire protection. The manufacturers may, therefore, insure in the New England Mutual Companies and take advantage of the lowest possible rates of insurance.

Fourth—Direct track connection with the piers and extensive water front facilities of this company, with its system of over fifty warehouses. The piers are themselves equipped with railroad tracks for their full length so as to permit of the operation of trains over them.

Fifth—A ferry service from 39th St., Brooklyn, immediately adjoining the plant of this company, to the Battery, Manhattan, and so within easy distance of business and financial centers of Manhattan Island.

Sixth—Direct track connection with the Brooklyn Rapid Transit Co., for which this company acts as terminal agent. This connection offers facilities for freight shipments by trolley freight cars to all points reached by the five hundred miles of track of the Rapid Transit Co., extending to every section of Brooklyn and many sections of the Borough of Queens.

Seventh—A trucking department for handling city deliveries at moderate charges.

Eighth—Electric light and power and steam heat and power in any quantity and at nominal rates.

Ninth—A location in the heart of the labor market of Brooklyn, where skilled and unskilled labor may be readily obtained, and also easily accessible to the labor markets of Manhattan Island.

The Bush Terminal R. R. extends from 28th St., South Brooklyn, to 65th St., connecting at that point with the Pennsylvania Railroad system. Along the line of this terminal road are located many sites suitable for manufacturing or shipping houses, which are not owned by this company.

NAVAL POWER PLANT CONSOLIDATION.

The Navy Department has approved the plans for the permanent consolidation of the power plants at the League Island Navy Yard, following out the approval of the tentative project submitted a few weeks ago. The cost of the important installation for which existing appropriations are available will be about $140,000, and the commandant at League Island has been authorized to instruct the civil engineers on duty there to proceed with the work of consolidation and expansion to that extent. The eventual capacity of the plant has been taken into consideration by the civil engineers who have made the designs for this project, and it is now possible when the growth of League Island so justifies to increase the central power plant to meet future needs, but for the present the sum named will enable the authorities to carry out the plans which have been approved. The department has also authorized important work at Puget Sound Navy Yard, where the general scheme has been approved, with the details yet to be worked out. The basis of the electrical generating plant will be alternating current. At Pensacola, Fla., Congress made provision for a central power plant by direct appropriation, and the only question now before the department has been the general plan of distribution of power to the different departments of the yard. Nothing has yet been done with the plans for the central power plant at the new navy yard at Charleston, S. C., but recommendations in regard to that place are expected shortly, taking into consideration the operation of the drydock pumping plant by electrically driven machinery. At Mare Island the questions of power plant consolidation are somewhat held up by the completion of the drydock mechanism. There is an unusual situation at that yard, in that the government is able to purchase its power from the Bay Counties Power Company at a very low rate. With the advent of the new drydock it may be necessary to add to this power, and it is considered a wise precaution to have a central power plant to meet extraordinary demands at the yard and to make the government independent, when necessary, of the contracting power company. At the New York yard the department has this week approved all the plans for the distributing system. Only a part of the work, to the extent of about $150,000, will be done at New York this year. The remainder will be done next year.

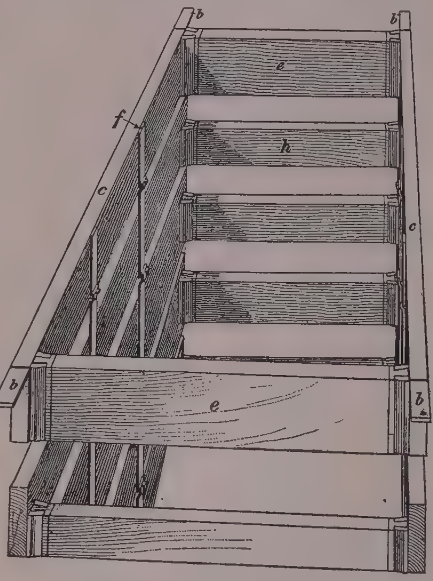
ADVERTISING ENGINEERS.

Products of scientific manufacture require promotion even more than do commercial articles of general consumption. The engineer or manufacturer who has spent years of work and thought upon the perfection of a new product or machine accepts as axiomatic that, because there is a need for it, there will be a demand. He forgets that before his possible customers will give up their accustomed and familiar methods to adopt the new, they must to some degree pass over the same mental course that he has traversed, and, unless educational measures are adopted, this is apt to be a matter of many years. To introduce his improvements in steam engine valve gears, Corliss was forced practically to giving his machines away. The Parsons steam turbine was an engineering success ten or twelve years before it became a commercial success in this country. On the other hand, the turbine centrifugal pump, by modern advertising methods, has been made commercially successful in a period of two years, the sales of the third year being four times those of the first, while a prominent cordage manufacturer has increased the sales of his transmission rope twenty times over within a few years by means of advertising. Not only, however, do engineering products require an educational publicity campaign for their introduction within reasonable time, but all the methods of general advertising, suitably modified, are in some way applicable in promoting their sale. There is a science of economy of communication and apprehension, as of other things, and some ways of overcoming psychological inertia are less expensive and attended with less friction than others.

Recognizing these facts, some engineering and manufacturing concerns have established advertising departments and have placed them in charge of men of high ability. This plan, however, is more expensive than most businesses justify and many firms attempt to handle the work through already overburdened executive officers, or else turn it over to clerks. To meet these conditions, Mr. Halbert P. Gillette, M. Am. Soc. C. E., M. Am. Inst. M. E., formerly associate editor of "Engineering News," and Mr. Geo. H. Gibson, A. M. Am. Inst. E. E., J. M. Am. Soc. M. E., formerly manager of publicity for the International Steam Pump Co., manager of the advertising department of the B. F. Sturtevant Co., and editor of the Westinghouse Companies' Publishing Department have formed a partnership as "advertising engineers," under the name of the Geo. H. Gibson Co., with offices in the Park Row Bldg., New York City. They undertake to conduct a firm's advertising in the same manner as would a department in the firm's own offices, and are not advertising agents in the usual sense of the term, as they receive no commissions, rendering only service and leaving the actual purchasing of space and printed matter in the client's hands.

SECTIONAL CRIBBING FOR TRENCHES.

A system of sectional cribbing has recently been developed by the United States Portable Cribbing Co., of Scranton, Pa., which consists of horizontal courses of lagging and braces suspended from scantlings at the top of the trench. The top course of lagging has brackets, *b, b,* at the ends of the sticks, *c, c,* which rest on the scantlings. The sticks *c, c,* have mortised boxes or stirrups attached to their sides, in which the ends of the braces, *e, e,* rest. The second course of lagging is hung from the first by the bars, *f,* which hook together. When the lagging has been hung in this way the second tier of braces, *h,* is slipped into the boxes, completing the installation of this course. This process is carried on to the bottom of the trench or pit.



SECTIONAL TRENCH CRIBBING.

THE POLLUTION OF NEW YORK BAY.

At a meeting of the New York Bay Pollution Commission on Aug. 1 the following resolution was passed, making a formal protest against planning for the discharge into New York Bay of any further large quantities of untreated sewage, particularly from non-riparian communities. The commission consists of Dr. Daniel Lewis, State Commissioner of Public Health, of New York; Louis L. Tribus, M. Am. Soc. C. E., Commissioner of Public Works, Borough of Richmond; Prof. Olin H. Landreth, Consulting Engineer, New York State Department of Public Health; Dr. Myron S. Falk, Consulting Engineer, New York State Water Commission; Dr. George A. Soper, Assoc. M. Am. Soc. C. E.:

"Whereas, at a regularly called meeting of the New York Bay Pollution Commission, held August 1, 1905, it was brought to its attention that large sewerage systems are being planned to empty into the waters of New York Harbor or waters immediately tributary thereto, untreated sewage, from non-riparian communities, it was

Resolved, That the commission considers that formal protest should be made against the discharge into New York Bay or adjacent waters of any considerable amounts of untreated sewage from non-riparian communities of either New York or New Jersey; and be it further

Resolved, That copies of these resolutions be transmitted to the officials or boards responsible for such contemplated sewerage improvements, and to the New York State Engineer and New York State Department of Health to the end that such contemplated systems may be provided with suitable purifying or disposal plants, so as to save free and harmless the waters of New York Harbor from further sewage contamination.

BUSINESS NOTES.

A. Leschen & Sons Rope Co., St. Louis, Mo., in June supplied to Lieut. Peary, the arctic explorer, for use on the arctic exploration ship "Roosevelt," two Hercules patent flattened strand hawsers of the following dimensions: One 100 fathoms long, ¾-in. diameter, and the other 200 fathoms long and ½-in. diameter. In one end of each hawser was spliced a hook and thimble, and in the other end a thimble and shackle of suitable proportions for developing the maximum strength of the hawsers.

The Michigan Pipe Co., Bay City, Mich., has closed the contract with the township of Republic, Mich., for about 8,200 ft. of 8-in. wood pipe; 4,666 ft. of 6-in. wood pipe; 5,396 ft. of 4-in. wood pipe, with special castings; 34 double discharge hydrants; about 32 valves and boxes for 360 ft. of 10-in. galvanized iron intake pipe, with galvanized elbows and nipples for flexible joints, and complete water works pumping plant, consisting of brick building, pump, machinery, boilers, etc. Cost of the works is to be about $25,000. Contract was signed August 18.

The Erie Railroad Company has awarded contracts to the Buffalo (N. Y.) Forge Co. for the following apparatus: Buffalo Fan System Heating and Ventilating outfit for their 42-stall round house at Buffalo, N. Y., requiring Buffalo steel plate 220-in. fan with belt connected 75-hp. motor, and heater containing 15 four-row sections, each section 6 ft. x 8 ft. 4 in. Buffalo Fan System Heating and Ventilating outfit for their 43-stall round house at Hornellsville, N. Y., requiring Buffalo steel plate 210-in. fan with belt connected 60-hp. motor and heater containing 20 two-row sections, each section 7 ft. x 9 ft. 4 in. Buffalo Fan System Heating and Ventilating outfit for their 21-stall round house at Galion, Ohio, requiring Buffalo steel plate 150-in. fan with direct connected 8 x 10 Buffalo engine and heater containing 10 four-row sections, each section 5 ft. x 6 ft. 10 in. Buffalo Fan System Heating and Ventilating outfit for their 21-stall round house at Huntington, Ind., requiring Buffalo steel plate 150-in. fan with direct connected 8 x 10 Buffalo engine, and heater containing 12 four-row sections, each section 5 ft. x 6 ft. 10 in. If the pipe alone used in these heaters were laid in single continuous length, the distance covered would be 6½ miles.

PERSONAL NOTES.

Mr. Samuel W. Perrot has been appointed dean of the Engineering School of the University of New Brunswick.

Mr. F. W. Williams, master mechanic of the Buffalo division of the Delaware, Lackawanna & Western R. R. has resigned.

Mr. F. F. Hallam, of McKeesport, has joined the engineering staff of the Pennsylvania State Highway Commission.

Mr. H. S. Moore has succeeded Frank C. Faust as chief engineer of the Missouri, Oklahoma & Gulf Ry., with headquarters at Muscogee, I. T.

Wm. S. Bacot has been elected president of the Consolidated Water Co. of Utica, N. Y., and will be succeeded as general manager by John F. Reagan, Jr.

Mr. Charles C. Egbert has been appointed mechanical engineer of the Canadian Niagara Power Co. and of the Niagara Falls Power Co.

A. J. Barr, a graduate of Washington and Jefferson College, in the engineer department of the Isthmian Canal Commission, died of yellow fever last week.

Mr. A. R. Eldridge has been promoted to the position of assistant bridge engineer of the Chicago, Burlington & Quincy R. R., with headquarters at Chicago.

Mr. Robert B. Livingston, formerly with the Allis-Chalmers Co. and W. S. Barstow, in electrical engineering work, has taken a position with the Engineering Co. of America, 74 Broadway, New York.

Mr. C. T. Theobald has been appointed city engineer of Elyria, O. He is a graduate of Purdue University, with considerable experience in the engineering department of the Lake Shore system.

Mr. R. F. Hayward, chief electrical engineer of the Utah Light & Power Co., has resigned to become general manager of the Mexican Light & Power Co., of the city of Mexico.

Mr. Wm. M. Belding, lately superintendent of construction of the George B. Swift Co., of Chicago, contractors for the Stuyvesant docks and elevators at New Orleans has been appointed general superintendent of building construction of the Isthmian Canal Commission.

Mr. Benjamin Douglas, bridge engineer of the Michigan Central R. R., has been appointed tunnel engineer of the company, in charge of construction of the Detroit River tunnel. He will report to Mr. W. S. Kinnear, head of the engineering commission having charge of the work.

Mr. James W. Sussex has been appointed as assistant engineer in the U. S. Reclamation Service at Casper, Wyo., and Mr. Wilbur S. Hanna has been transferred to the Washington office for work in the hydrographic division.

Freeling Tufts, formerly chief engineer of the Central Branch Union Pacific R. R., died at Harbor Beach, Mich., on Aug. 15. He was connected with the engineering department of the Erie, Chicago & Northwestern, and Chicago, Rock Island & Pacific lines.

The Dutch government recently appointed Prof. Jacob Kraus, of the Technical University at Delft, as its delegate on the board of advisory engineers for the Isthmian Canal Commission. Prof. Kraus is best known for his connection with the harbor works of Valparaiso, Chili, and after his appointment on the American board he was given a cabinet position which prevents his visit to the United States. Accordingly Mr. Johan Wilhelm Welcher, supervisor of the rivers of The Netherlands, has been appointed to the canal advisory board.

Samuel B. Sears, formerly city engineer of Kingston, N. Y., died at Yonkers recently. At the age of nineteen he was engaged in the construction of railroads in Vermont, and later was appointed resident engineer of the Great Western Railroad, with headquarters in Canada. He was employed in the construction of the Erie Canal, and superintended the construction of the West Point tunnel of the West Shore Railroad. In 1883 he was appointed City Engineer of Kingston, N. Y., and in 1896 Engineering Inspector of Pavements in New York.

Mr. W. S. Newhall, for many years chief engineer of the Wabash R. R., has resigned this office in order to engage in a private manufacturing enterprise, and will be succeeded by Mr. A. O. Cunningham, at present bridge engineer. Mr. Newhall was educated at the Pennsylvania Military College and began his engineering work in 1883 as a chainman on the Pennsylvania R. R. By 1889 he had risen to the grade of assistant engineer on the Chicago, St. Louis & Pittsburg line, and in 1893 he was appointed engineer of maintenance of way of the Toledo division of the Pennsylvania Co. In 1900 he was appointed chief engineer of the Wheeling & Lake Erie R. R., from which he was promoted to the position he has just resigned. Mr. Cunningham began his engineering work as a rodman on the Northern Pacific R. R. in 1886, and a few years later was a land surveyor in North Dakota, after which he studied engineering at the University of Minnesota. From 1894 to 1896 he was with the engineering department of the Gillette-Herzog Mfg. Co., and then spent several years in general engineering and contracting work, part of the time on important mill plants of the Pittsburg Reduction Co. In 1900 he joined the American Bridge Co., and a little later became bridge engineer of the Wabash R. R.

A department of electric railway engineering has been established at the Worcester Polytechnic Institute under the general direction of Prof. H. B. Smith, with Mr. Albert Sutton Richey, of Indianapolis, as assistant professor in charge. He was graduated from the electrical engineering course at Purdue University in 1894 and was engaged in general electrical engineering work for the next four years. He then entered the employment of the Citizens' Street Railway Co. at Muncie, where he was until 1899, having charge of the mechanical and electrical engineering. He then became associated with the Marion City Railway Co., at Marion, Ind., and remained with it until September, 1899, when he accepted a position as chief electrician of the Union Traction Co. of Indiana, and remained until March, 1900. This company made him electrical engineer, and he remained in that position until the interests of the company were absorbed by the Indiana Union Traction Co., in June, 1903. He then became the electrical engineer of the Indiana Union Traction Co., continuing as such until January, 1905. Since January he has been chief engineer of the Indiana Union Traction Co., which is the largest interurban electric railway system in the world operating with high potential transmission circuits from a single power station. About 400 miles of track are included in the system.

A civil service examination to fill eight vacancies in the Corps of Civil Engineers, U. S. Navy, will be held at the New York Navy Yard beginning Oct. 9, 1905. No person under 23 or over 28 years old will be appointed. The character of the examination is indicated by the questions printed in The Engineering Record of Feb. 16 and 23, 1901. The subjects are English grammar and composition; elementary physics, elementary geology, drawing, arithmetic, algebra, geometry, trignometry, analytical geometry, differential and integral calculus, applied mathematics, including mechanics of solids and fluids and strains in structures; electricity, construction materials, engineering constructions, such as workshops, steam and electrical machinery; quay walls, wharves, sewers, yard railways, pavements, water distribution, foundations, etc.; surveying (topographical, trigonometrical, and hydrographical) and mapping; instruments, their use and adjustment. Applications for permits to be examined must be made to the Secretary of the Navy, and must be accompanied by testimonials as to character, evidence of American citizenship, evidence of having received a degree in the civil engineering course of some professional institution of good repute, with a record of at least two years' practical experience as a civil engineer. No person shall be admitted who has been examined at any time within one year prior to the date of this examination and failed to meet the professional requirements, or who has twice failed professionally. A physical examination must also be passed.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Carbon Hill, Ala.—See "Power Plants, Gas and Electricity."

Gadsden, Ala.—Bids will be received until Sept. 15 by C. D. Clarke, City Clk., for $100,000 water works bonds, $30,000 sewer bonds and $20,000 street and sidewalk improvement bonds. Charles P. Smith, Mayor.

Yuma, Ariz.—The following are the bids opened on Aug. 17 at the office of D. W. Murphy, Acting Superv. Engr., 1108 Braly Bldg., Los Angeles, Cal., for the construction of about 12 miles of dike for the reclamation of Yuma Valley, Ariz.: (*a*) Miller & Peasley, 233 Wilcox Bldg., Los Angeles, Cal., (2 bids) (1) entire schedule $66,325, (2) one or more items; (*b*) Grant Bros. Const. Co., 604 Trust Bldg., Los Angeles, Cal., $86,275 entire schedule; (*c*) J. G. White & Co., 43 Exchange Pl., New York, N. Y., $91,662 entire schedule, and (*d*) Shattuck Desmond Warehouse Co., 9th and Alameda Sts., Los Angeles, Cal., (2 bids) (1) entire schedule $98,662, (2) one or more items.

	Excav. 445,000 cu. yds.	Overhaul, price per cu. yd. per 100 ft.	Clearing and grubbing, 125 acres, per acre.
(*a1*)	$.13½	$.01	$.50
(*a2*)	.14	.01	..
(*b*)	.17	.02½	.85
(*c*)	.18	.01	.90
(*d1*)	.21¾	.02	.15
(*d2*)	.30	.04	.25

Redonda, Cal.—The Redonda Water Co. is reported to have decided to expend about $50,000 in improvements, to include new wells and a new reservoir.

**Denver, Colo.*—The Denver Engr. Works Co. will probably receive from the Denver Union Water Co. (Geo. Prince, Ch. Engr.) the contract covering the installation of power machinery, consisting of water turbines, steam turbines, centrifugal pumps, two horizontal tubular boilers, together with condensing apparatus, air pumps, feed-water heater and feed-water pumps. The Mountain Electric Co., of Denver, Colo., will receive contract covering the installation of an electric light plant at a cost of about $4,400.

Perry, Fla.—H. S. Jaudon, of Savannah, Ga., is stated to have been employed to prepare plans and superintend the construction of water works at Perry.

Ft. McPherson, Ga.—Bids will be received until Sept. 6 (readvertisement), by Capt. B. B. Buck, Constr. Q. M., for furnishing material and constructing a reservoir, pump house, and installing machinery for air lift system and making connections with deep well and water system as advertised in The Engineering Record.

Chicago, Ill.—Bids will be received by the Dept. Pub. Wks. (J. M. Patterson, Comr.) until Sept. 6 for furnishing materials and constructing about 28 lin. ft. 5-ft. tunnel, including bulkheads, etc., at the Chicago Ave. Pumping Station also for constructing and delivering at said station 3, 36-in. hydraulic lift gate valves.

**Mt. Vernon, Ill.*—The following are the bids received Aug. 15 at the office of John W. Alvord and Chas. B. Burdick, Engrs., 1207 Hartford Bldg., Chicago, Ill., for constructing a reservoir embankment and appurtenances for the Citizens' Gas, Electric & Heating Co., at Mt. Vernon: J. M. Doolittle & Son, Huntington, Ind., $13,440 (awarded contract), and A. D. Thompson, Peoria, Ill., $15,158. The detail bid of the successful bidder was as follows: 36,000 cu. yds. embankment, 30 cts. per cu. yd.; 520 ft. sheeting, $1 per ft.; 600 cu. yds. rock excav., $1.50 per cu. yd.; 80 cu. yds. concrete, $9 per cu. yd.; bridge, $175, and outlet pipe, $325.

Chicago, Ill.—Bids will be received until Aug. 30 by the Bd. Local Improv. (And. M. Lynch, Pres.) for water supply pipes in portions of numerous streets.

Clinton, Ill.—Water works improvement bonds to the amount of $8,000 are reported sold.

McLeansboro, Ill.—The City Clk. writes that bids will probably be received in September for the construction of a reservoir to cost about $10,000. Engineer, R. G. Allen.

**Bloomington, Ill.*—The Crescent Stone Co., of Peoria, is stated to have secured the contract for constructing a reservoir (bids opened Aug. 4) for about $43,000.

Marlow, Ind. Ter.—The Town Council is stated to have passed a resolution asking the Mayor to call an election to vote on issuing $20,000 bonds for water works.

Independence, Kan.—The citizens are reported to have voted Aug. 11 to issue $100,000 bonds, to purchase plant of the old water company and build a new system.

Somerset, Ky.—W. G. Hunter, of Somerset, has received the water works franchise, bids for which were received Aug. 14. T. R. Griffin, Mayor.

Newport, Ky.—A reservoir is to be constructed in the Highlands. W. L. Glazier, Newport, Engr. in Charge.

Princeton, Ky.—Bids will be received until Sept. 5 by the City Council for furnishing material and constructing a system of water works, as advertised in The Engineering Record.

Springfield, Mass.—The following are reported to be the bids opened on Aug. 13 by the Water Comn. for 3,000 ft. of 6-in. water pipe (price given per ton): M. J. Drummond & Co., New York, N. Y., $28.70; R. D. Wood & Co., Philadelphia, Pa., $28.50; Chas. Millar & Sons Co., Utica, N. Y., $28.20; Warren Fdy. & Machine Co., New York, N. Y., $28, and the U. S. Cast Iron Pipe Co., Philadelphia, Pa., $27.90.

South Framingham, Mass.—The Town Clk. writes that it is proposed to extend the water system to Saxonville. Engineer, G. G. Van Valkenburgh.

Falmouth, Mass.—Bids will be received until Sept. 4 for laying about 3½ miles of 8 and 6-in. c.-i. water pipe and appurtenances, as advertised in The Engineering Record.

Welcome, Minn.—Bids will be received until Sept. 15 by C. H. Oltman, Village Recorder, for $7,000 water bonds.

Thief River Falls, Minn.—Bids are wanted until Sept. 4 (extension of date) for a 750-gal. per minute triplex power pump, a 300-gal. per minute deep well pump and a 30-hp., 220-volt direct-current motor all installed. O. Clausen, Consulting Engr., St. Paul.

Hayfield, Minn.—It is reported that bids will be received until Sept. 1 by E. C. Hellecksen, Village Recorder, for 1,206 ft. 6-in. water pipe, 3 hydrants, 1 gate valve, etc.

Kansas City, Mo.—Local press reports state that the following work has been mapped out in a recent consultation of the Bd. of Pub. Wks., with Geo. H. Benzenberg, of Milwaukee, Wis.: As soon as the final soundings are taken plans are to be prepared for a new intake farther up Missouri River; steps are to be taken to protect the bank of Missouri River above present intake where government revetment work has washed out; an additional 30,000,000-gal. pump is to be installed at Quindaro; a 42-in. suction pipe is to replace the 30-in. pipe at the present intake pending the construction of the new intake; the tunnel under Kaw River, for which specifications will shortly be prepared, is to be made longer than originally intended so as to anticipate the probable widening of the channel of Kaw River by the Kansas City, Kan., Drainage Comn.; the tunnel will cost $150,000; the 48-in. flow line from the tunnel to Turkey Creek pumping station is to be completed.

Glendive, Mont.—H. J. Halvorsen, City Clk., writes that plans are about completed by E. S. Baer, of Glendive, for water works and a sewerage system, to cost about $50,000. Bids will be received about Sept. 25.

Perth Amboy, N. J.—It is stated that bids will be received until Aug. 30 by the Bd. Water Comrs. (Adam Eckert, Clk.) for laying about 3,500 ft. 6-in. water pipe, including specials.

**Lyndhurst, N. J.*—Bids were opened on Aug. 14th at Lyndhurst by the Committee of Union Township, Bergen County, for furnishing material and laying 5.9 miles of c. i. pipe and appurtenances; the bids were submitted in three sections, A, B and C. (Engineer, Walter C. Hyatt, Ridge Road, Kingsland, N. J.)

*Section A.—For furnishing pipe and specials f. o. b. cars Kingsland: The Central Fdy. Co., 116 Nassau St., New York, N. J., secured the contract for this section at the following detailed bid for Universal pipe: 400 lin. ft. 4-in., 31¼ cts.; 22,400 lin. ft. 6-in., 50 cts.; 900 lin. ft. 10-in., 95½ cts., and 7,050 lin. ft. 12-in., $1.23; total, $21,431. The totals of the other bids on this section were: For Universal pipe, Whetstone & Co., Inc., Philadelphia, Pa., $21,910, and for Hubbard Spigot pipe, Donaldson Iron Co., Emaus, Pa., $18,396; Robt. W. Smith, 136 Liberty St., New York, N. Y., $18,724; Camden Iron Wks. (R. D. Wood & Co., Philadelphia, Pa.), $19,133, and the U. S. Cast Iron Pipe & Fdy. Co., New York, N. Y., $20,801.

*Section B.—Hydrants, gate valves and valve boxes: Fairbanks Co., of New York, N. Y., secured the contract for this section for a total of $1,230, using Universal joint; time of delivery, 60 days.

*Section C.—Laying pipe; setting hydrants, etc.: John P. Richards & Co., 2707 N. Broad St., Philadelphia, Pa., secured the contract for this section, at the following detailed bid on Universal pipe: Laying 400 lin. ft. 4-in. pipe, 10½ cts.; 22,400 lin. ft. 6-in., 11½ cts.; 900 lin. ft. 10-in., 12 cts.; 7,050 lin. ft. 12-in., 12 cts.; setting 30 hydrants, each, $3; 450 cu. yds. rock excavation, $1, and for 4 manholes, each, $450; total, $4,304. The totals of the other bids received on this section were as follows: *a* laying hub and spigot pipe, *b* laying Universal pipe: D. Cuozzo, 150 Nassau St., New York, N. Y., *a* $8,070; *b* $6,432. Lewis Van Duyne, Boonton, N. J., *a* $8,662; *b* $7,078. Robt. W. Smith, 136 Liberty St., New York, N. Y., *a* $8,887; *b* $7,652. Harrison Constr. Co., Newark, N. J., *a* $9,204; *b* $7,247. Fritz & Partridge, Butler, N. J., *a* $9,616; *b* $7,540. Peter Mullin, Minooka, Pa., *a* $9,659; *b* $8,244. John T. Harrop, Garfield, N. J., *a* $10,602; *b* $8,759. F. E. Spinner, 35 Warren St., New York, N. Y., *a* $10,649; *b* $7,983. Neff & Co., 42 Broadway, New York, N. Y., *a* $10,792; *b* $9,431. G. H. Eldridge, Ossining, N. Y., *a* $11,323; *b* $10,108. Albany Constr. Co., Albany, N. Y., *a* $12,206; *b* $9,005. Williamson & McLaughlin, Philadelphia, Pa., *a* $15,247; *b* $14,154.

Garfield, N. J.—Bids will be received until Aug. 30 by the Mayor and Borough Council, for distributing, laying, etc., about 36,800 lin. ft. of 3 to 10-in. pipe, hydrants, etc., the pipe, hydrants, gate valves and specials to be supplied by borough; also another proposition to furnish all pipe, hydrants, gate valves, etc., to lay, etc., the same, as advertised in The Engineering Record.

Roseland, N. J.—The Roseland Water Co. has been incorporated to lay pipes for a supply of water in Roseland. Essex Fells will supply the water. Mary J. Condit, Eagle Rock Ave., Roseland, is the principal agent.

Atlantic City, N. J.—Local press reports state that at a meeting of members of the City Counccil, Bd. of Trade, Hotel Men's Assoc. and Water Comrs., on Aug. 15, it was decided to recommend to City Council the construction of about 5 water reservoirs, a new wood-stave main across the meadows, new pumping station and other improvements; probable cost of the work is $500,000. Kenneth Allen, Engr. and Supt. Water Dept.

Burlington, N. J.—Bids will be received until Sept. 19 by the Bd. Water Comrs. for a compound condensing crank and fly-wheel pumping engine of a capacity of 3,000,000 gals. per 24 hours, as advertised in The Engineering Record.

**Items marked thus give the names of parties awarded contracts.*

Perth Amboy, N. J.—Plans and specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for furnishing and erecting an 8,000,000-gal. pumping engine, bids to be opened Aug. 30, as advertised in The Engineering Record of Aug. 19. Engineer, Saml. J. Mason, 102 Smith St., Perth Amboy.

Brooklyn, N. Y.—Bids will be received by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, until Sept. 6, for furnishing and erecting 2 new brick chimneys at the new Ridgewood Pumping Station; for furnishing, delivering and erecting the necessary steam fittings, with all auxiliaries, complete at the Gravesend Pumping Station; furnishing, delivering, erecting and connecting 2 pumping engines, including foundations, auxiliaries and piping, at the new New Lots Pumping Station. Bids will also be received for furnishing, delivering and laying water mains and removing existing water mains in several streets; also for hauling and laying water mains and appurtenances, all in Boro. Brooklyn.

New York, N. Y.—Bids will be received until Sept. 6 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in numerous streets, Boros. Manhattan and Bronx.

**Brooklyn, N. Y.*—Ryan & McFerran, 106 E. 23d St., N. Y. City, are stated to have secured the contract for constructing the new Gravesend pumping station (bids opened Aug. 9) for $22,733.

**Troy, N. Y.*—The Bd. of Contract and Supply is stated to have awarded the contract for the permanent opening in the Tomhannock dam to the J. W. Bishop Co., of Worcester, Mass., for $24,360. The only other bid received for this work on Aug. 8 was submitted by Michael McDonough, of Troy, for $24,582.

Albuquerque, N. M.—See "Power Plants, Gas and Electricity."

Troy, N. Y.—Bids will be received until Sept. 1 for $181,500 water works bonds. Wm. H. Geary, Compt.

Roswell, N. M.—Bids will be received until Oct. 17 at the office of the U. S. Reclamation Service, Roswell, N. M., for the construction and completion of earth embankments, involving about 200,000 cu. yds. of earth work and 150,000 cu. yds. of overhaul, at a point about 12 miles southeast of Roswell, as advertised in The Engineering Record.

Spencer, N. C.—Henry A. Pressey, of Washington, D. C., is reported to have secured a franchise to construct water works at a cost of $50,000.

Wilmington, N. C.—The Bd. of Aldermen has adopted a resolution providing for the issue of $150,000 bonds for the establishment of municipal water works.

**Ravenna, O.*—A. W. Stocker, Clk. Bd. Trus. of Public Affairs, writes that John Sorensen, of Ravenna, has secured the contract for erecting a low-service pumping plant at Muzzy (bids opened Aug. 18) for $6,408.

Hamilton, O.—Harry J. Thompson, Supt. Water Wks., in his report to the Bd. of Pub. Service, recommends the laying of the water mains petitioned for, also that steps be taken toward the construction of a complete pumping station.

Wyoming, O.—Bids will be received until Sept. 6 by W. A. Clark, Village Clk., for $3,000 bonds, issued for the purpose of extending the water mains.

Toledo, O.—Bids will be received until Sept. 11 (extension of date) by the Bd. Pub. Service (Harry Jones, Secy.) for constructing sections 1 and 2 of the filtered water concrete conduit, to be about 4,100 and 2,900 ft. long, 6 ft. internal diameter respectively; bids will be received for construction in open cut and tunnel. Bids on labor and material to be submitted separately. Chas. L. Parmlee, Engr., 136 Liberty St., New York, N. Y.

Marietta, O.—A. F. Cole, City Engr., writes that bids are wanted Aug. 30 for the construction of 5,000 ft. 6 and 4-in. water line, 5,000 ft. 15, 12, 10 and 8-in. pipe sewers, 2,000 ft. 4-in. lateral sewers, manholes, etc.

Newark, O.—All bids received Aug. 12 for constructing a water works system here have been rejected. Changes are to be made in the plans and the work readvertised immediately. Lewis K. Davis, Consulting Engr., New York, N. Y.

Struthers, O.—David M. Wise is the engineer in charge of the reservoir which is to be constructed here by the Mahoning Valley Water Co., of Youngstown. (Jas. J. McNally, Secy.).

Malta, O.—The citizens are reported to have voted to issue $7,000 bonds for water works.

Shawnee, Okla. Ter.—See "Schools."

Oklahoma City, Okla. Ter.—J. F. Messenbaugh, Mayor, writes that W. C. Burke is the engineer who will have charge of the proposed water works and sewerage systems which are to be constructed here at a cost of about $375,000.

Drain, Ore.—See "Power Plants, Gas and Electricity."

**Cottage Grove, Ore.*—J. E. Young, City Recorder, writes that Geo. Lea, of Cottage Grove, has secured the contract for constructing water works, using all-wood pipe, for $15,358 (bids opened Aug. 14). The other bids received were from the Puget Sound Bridge & Dredge Co., Tacoma, Wash., $23,269; Jacobson, Bade & Co., Portland, $15,830, and Paquet & Gilbrisch, Portland, $15,797.

Pottsville, Pa.—This city is reported to have voted to issue $20,000 bonds for a new water supply.

**Allegheny, Pa.*—The International Contr. Co., of Pittsburg, is stated to have secured the contract for laying water pipe in Sycamore, Main and Lacock Sts. and Madison and Perryville Aves., for $8,360.

Indiana, Pa.—Hugh M. Bell, Secy. Clymer Water Co., writes that plans are being prepared for improvements to the water works, to cost from $40,000 to $60,000. Engineer, A. M. Wonder.

Harrisburg, Pa.—Press reports state that bids will be received by the Water Bd. until Aug. 29 for laying a 6-in. water pipe in portions of 18th, Hummel and Forrest Sts. and Dauphin Ave.

Dover, Pa.—Bids will be received until Sept. 6 by Jacob H. Kann, Town Clk., for pipe and laying, tower and tank, power house and engine, specials, valves and boxes, as advertised in The Engineering Record.

Columbia, Pa.—Bids will be received until Sept. 5 by the Columbia Water Co., 204 Locust St., for constructing a concrete dam and side coping walls containing about 1,200 cu. yds. for the support of a corrugated iron roof to the reservoir of the Columbia Water Co., as advertised in The Engineering Record.

**Columbia, S. C.*—The contract for the general construction of the new water works (bids opened Aug. 8) is stated to have been awarded to Geo. O. Tenney, of Spartanburg, for $153,694.

**Parkston, S. D.*—W. D. Lovell, of Minneapolis, Minn., is stated to have secured the contract for constructing water works (bids opened Aug. 9) for $14,198.

Aberdeen, S. D.—The Chicago, Milwaukee & St. Paul Ry. Co. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) is stated to have decided to construct a new reservoir at Aberdeen.

Tripp, S. D.—It is reported that the water works will be remodeled and a new engine purchased.

Galveston, Tex.—Bids will be received until Sept. 21 by the City Comrs. for furnishing and erecting complete mechanical equipment of a pumping station at Alta Loma, Tex., consisting of two 4,000,000-gal. pumping engines, two 100-hp. boilers, and a 40-light generator, including all accessories, as advertised in The Engineering Record.

San Felipe, Tex.—Engr. A. Ludwig, of Sealy, writes that he is making a survey for an irrigation canal, but nothing definite has yet been done.

Pleasant Grove, Utah.—Lyman & Wilson, Metallurgy Bldg., Salt Lake City, have been selected to prepare plans and superintend the construction of water works, providing the citizens vote in favor of the construction.

Salt Lake City, Utah.—During the coming fall Lyman & Wilson, Metallurgy Bldg.,, will probably construct for the University of Utah a hydraulic laboratory, in which will be 2 canals built of reinforced concrete. One canal to be 150 ft. long, 16 ft. wide and 10 ft. deep, the other 100 ft. long, 6.58 ft. wide and 8.28 ft. deep.

Ft. Myer, Va.—Bids will be received until Sept. 15 by Capt. A. W. Butt, Q. M., U. S. A., Quartermaster's Dept., Washington, D. C., for constructing an intake pipe and steel tank and trestle for water supply system at Ft. Myer, Va., as advertised in The Engineering Record.

Edinburg, Va.—The question of constructing water works is reported under consideration here.

**Seattle, Wash.*—The Pacific Coast Pipe Co., of Ballard, has secured the contract for laying water mains on Meadow Place for $11,993.

L. B. Youngs, Supt. Water Wks., has recommended to the Water Com. of Council improvements to the water system, to cost about $400,000, to include 3 new reservoirs, a new standpipe and an additional electrical pumping station for high service.

Tacoma, Wash.—It is proposed to secure a gravity system of water works, and the preliminary work is now under way. Frank L. Davis, City Engr.

Walla Walla, Wash.—It is reported that surveys are now being made for a new water supply.

Vancouver Barracks, Wash.—Bids willl be received until Sept. 28 at the office of the Constructing Q. M., U. S. A., for the construction of a reinforced concrete water tank of 100,000-gal. capacity, as advertised in The Engineering Record.

**West Allis, Wis.*—Chas. J. Poetsch, City Engr. of Milwaukee, writes that the following are the totals of bids opened on Aug. 19 for furnishing material and constructing the distribution portion of the water works to be constructed for West Allis, to consist of 9,023 ft. 12-in. pipe, 11,277 ft. 8-in., 16,473 ft. 6-in., and 59 hydrants: Forrestal & Downey, Milwaukee, $44,980; J. W. Mitchell, Madison, $52,600; C. J. Crilley, Milwaukee, $52,195; J. H. Whalen, Milwaukee, $50,192; J. M. Healey, Chicago, Ill., $44,778; Jos. A. Meyers, Milwaukee, $49,464; J. H. Roche, Chicago, Ill., $56,000; Baker & Pitz, Manitowoc, $51,816; Jas. O'Donnell, Milwaukee, $49,644, and American Light and Water Co., Kansas City, Mo., $42,678 (awarded contract).

Casper, Wyo.—The following are the bids opened on Aug. 16 at the office of the U. S. Reclamation Service, U. S. Geological Survey, Denver, Colo., for the construction of the Pathfinder dam and auxiliary works, 50 miles s. w. of Casper, to impound flow of North Platte River: (*a*) N. S. Sherman, Oklahoma City, Okla.; (*b*) Geddes & Seerie Stone Co., 611 Continental Bldg., Denver, Colo.; (*c*) Kilpatrick Bros. & Collins Contr. Co., Beatrice, Neb.; (*d*) Wyttenbach & Dunnegan, Sturgis, S. D.; (*e*) J. G. White Co., Inc., 43 Exchange Pl., New York, N. Y.; (*f*) The Keltie Stone Co., Joliet, Ill.:

	a	*b*	*c*	*d*	*e*	*f*
Masonry—						
Portion of dam above el. 5,660, including bastions and guide walls, 50,000 su. yds.	$6.00	$6.25	$6.80	$7.50	$7.50	$8.35
Portion of dam below, 3,000 cu. yds.	8.40	9.00	15.00	10.40	8.00	8.65
Excavation for foundation of dam and for spillways—						
Class 1, 2,500 cu. yds.	1.40	2.00	5.00	2.50	2.25	1.21
Class 2, 500 cu. yds.	5.60	6.00	10.00	6.00	18.00	3.00
Class 3, 2,000 cu. yds.	2.10	4.00	3.00	3.00	4.50	2.50
Concrete in bridges, towers, spillways and guide-walls, 1,000 cu. yds.	7.56	6.50	7.50	7.00	12.00	4.75
Hauling cement from Casper to dam site, 40,000 bbls.	2.90	3.00	3.25	3.00	2.99	3.00
Total	$459,260	$482,000	$546,000	$548,450	$554,225	$577,725

Monterey, Mex.—The concession for the construction of water works and drainage systems in Monterey granted to Jas. D. Stocker and Wm. Walker are reported to have been transferred to MacKenzie Mann & Co., Ltd., of Montreal, Que. The company also holds interests in the Mexican Light & Power Co., of Mexico City, which recently bought up all competing companies and is completing the construction of a hydro-electric power plant at Necaxa. The company is also reported to have taken over the street car systems and concessions in Monterey, and work of electrifying the lines will, it is stated, be started at once.

Sudbury, Ont.—Bids will be received until Sept. 4 by Stephen Fournier, Town Clk., for furnishing material and constructing extensions to the water works requiring 2,000 ft. of 6-in. and 2,500 ft. of 4-in. pipe and hydrants, and for furnishing material and extending the sewers, requiring 5,000 ft. 6-in., 2,600 ft. 8-in., 1,620 ft. 9-in., and 1,420 ft. 10-in. pipe.

Owen Sound, Ont.—The Town Council is reported to have employed Willis Chipman, of Toronto, to report on the question of increasing the water supply.

Ft. Williams, Ont.—A. McNaughton, City Clk., writes that the ratepayers willl vote in December on the question of appropriating $225,000 for a new water supply.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—See "Water."

New Haven, Conn.—City Engr. Kelley is reported to have decided to ask the Bd. of Aldermen to authorize the Controller to issue about $50,000 bonds for the construction of the State St. sewer overflow.

Washington, D. C.—Bids will be received until Aug. 30 by Capt. A. W. Butt, Q. M. U. S. A., for constructing sewer from coal testing plant on U. S. Reservation at south end of Aqueduct Bridge, Rosslyn, Va., to the Potomac River.

Bids will be received until Sept. 7 by the Comrs. D. C. for constructing sewers in Dist. of Columbia, as advertised in The Engineering Record.

The following are the bids opened on Aug. 21 by the Comrs. D. C. for specials for the outfall sewage disposal system: U. S. Cast Iron Pipe & Fdy. Co., Philadelphia, Pa., $15,950, and Camden Iron Wks., Philadelphia, Pa., $14,626.

Washington, D. C.—The following are the bids opened on Aug. 21 for the construction of sewers in the Dist. of Columbia; D. E. McComb, Supt. of Sewers: *a* J. Connelly Constr. Co., $34,195; *b* J. H. Louchheim, $40,135:

	a	*b*
12,500 cu. yds. excav.	$0.89	$1.26
20 cu. yds. brick masonry	12.00	12.00
220 cu. yds. vitr. masonry	20.00	19.50
1,200 cu. yds. concrete "B"	6.90	7.40
1,500 cu. yds. concrete "C"	6.65	7.20
700 lin. ft. underdrain	.25	.25

Boise, Idaho.—Bids will be received until Sept. 9 by Jos. Beal, City Clk., for building lateral sewers and appurtenances. The work includes approximately 22,300 lin. ft. 8-in. vitrified pipe, 60 manholes, 15 flush tanks and 4 flush lines with settling basins.

Sandwich, Ill.—The Iowa Eng. Co., Clinton, Ia., is preparing plans, estimates and specifications for a complete sewerage system for Sandwich.

Winnetka, Ill.—The following are the bids opened on Aug. 10 by the Bd. of Local Improv. for constructing a sewage ejector station, including by-pass, receiving and ejector chambers, outlet on Elm St., 27 manholes, about 6,408 ft. of 8-in. pipe sewer and 2,400 ft. 3-in. and 3,130 ft. 6-in. c.-i. sewer pipe, etc. (Engineer, F. A. Windes): F. G. Mortimer, Glencoe, $14,750; G. I. Myrick, Morgan Park, $14,827; Jas. H. Roche, Chicago, $14,939; Edw. M. Laing, Highland Park, $15,116; Andrew Thomsen, Racine, Wis., $15,858, and John M. Healy, Chicago, $17,333.

East St. Louis, Ill.—W. J. Crocken, City Engr., will be in charge of the construction of the outlet sewer, plans for which are being prepared; it will be constructed of concrete, except one small branch, which will be 36-in. pipe. The cost willl be $758,000.

Indianapolis, Ind.—The Bd. of Pub. Wks. has adopted a resolution providing for the construction of a main sewer, 24 in. diam., on Meridian, 27th and 28th Sts. and Talbott Ave., from Fall Creek to Central Ave.

Centerville, Ia.—Bids will be received until Sept. 5 for 2 miles of sanitary sewers, 8, 10 and 12-in. pipe. C. S. Wycoff, Mayor. Engineers, Iowa Engr. Co., Clinton.

New Hampton, Ia.—Bids will be received until Sept. 6 by F. B. Strike, City Clk., for constructing a sewer and sewage disposal plant. M. Thschirgi, Engr., Room 402, Bank and Insurance Bldg., Dubuque.

Ida Grove, Ia.—The City Council has decided to employ Prof. A. Marston, of Ames, to prepare maps, surveys, grades and plans for a sanitary sewer system, to be put in on 1st St.

Lawrence, Kan.—Bids are wanted Sept. 4 for the construction of main and lateral sewers, as advertised in The Engineering Record.

Lexington, Ky.—Bids will be received until Sept. 13 by the Mayor for furnishing material and constructing 3 main sewers, requiring 34,230 ft. 8 to 24-in. pipe, 5,400 ft. 5-in. pipe for house connection, 115 manholes, etc., as advertised in The Engineering Record.

Lowell, Mass.—The Bd. of Aldermen has passed loan orders of $50,000 for sewers and $35,000 for streets.

Owosso, Mich.—Bids will be received until Sept. 6 by the Bd. Pub. Wks. for constructing 2,136 lin. ft. of 10-in. and 1,116 ft. of 12-in. vitrified pipe sewer, also 12 lin. ft. of 10 and 312 ft. of 12-in. c. i. pipe outlet, together with 10 manholes, 2 flush tanks and 1 lamp hole, as advertised in The Engineering Record.

Lansing, Mich.—Estimates have been presented to City Council for sewers in Larch and Sheridan Sts., to cost $10,330, to consist of 2,110 ft. 18-in. pipe to 35 x 45 in brick. H. A. Collar, City Engr.

**Items marked thus give the names of parties awarded contracts.*

**New Britain, Conn.*—The following are the bids opened on Aug. 15 by the Bd. of Sewer Comrs. for the construction of Section B of the proposed sewerage system (Wm. H. Cadwell, Engr.) : (*a*) Unique Constr. Co., 294 3d Ave., Brooklyn, N. Y., $32,132 (awarded contract); (*b*) Henry Spinach, $48,749; (*c*) Falvey & Kelly, $50,731; (*d*) David R. Courtney, $40,718:

	**a*	*b*	*c*	*d*
Pipe sewer—				
641 lin. ft. 20-in.	$1.75	$2.15	$2.00	$2.00
4,025 lin. ft. 18-in.	1.25	2.25	3.00	1.75
4,106 lin. ft. 15-in.	1.20	2.00	2.50	1.50
1,786 lin. ft. 12-in.	1.05	2.00	2.50	1.50
2,725 lin. ft. 10-in.	.95	1.96	2.00	1.25
723 lin. ft. 8-in.	1.00	1.85	1.75	.80
3,720 lin. ft. 6-in.	.45	1.00	1.00	.55
53 manholes	35.00	56.00	50.00	65.00
120 lin. ft. other 12-in. pipe	1.05	1.05	.70	1.50
500 cu. yds. rock excav.	3.00	4.50	5.00	4.50
320 lin. ft. other 20-in. pipe	1.75	1.75	1.00	2.00
2,864 lin. ft. other 15-in. pipe	1.20	1.11	.80	1.50
6,713 lin. ft. other 12-in. pipe	1.00	1.05	.65	1.00

Crystal Falls, Mich.—Construction will probably commence this fall on the proposed sewerage system. Engineer, E. G. Bradbury, 85 N. High St., Columbus, O. Robt. Munns, City Clk.

**Mankato, Minn.*—Alex. Bashaw is stated to have secured the contract for constructing a sewer on Broad St. for $4,193.

St. Paul, Minn.—A preliminary order is stated to have passed Council for a system of sewers in Earl, Minnehaha, Beach and other streets, and as there is no natural outlet for the proposed sewers, City Engr. Rundlett recommends the construction of a system of sanitary sewers for house drainage only, and to install a pumping plant at Terry and Beach Sts., to pump the sewage to a connection with the main sewer on 7th St.; probable cost of work is $15,000.

Brookhaven, Miss.—The Sanitary Com. appointed by the City Bd. of Health, is stated to have reported, recommending the construction of a sewerage system.

Ambler, Pa.—The Ambler Sewer Co. has presented to Council a proposition to equip the borough with a sewerage system.

Nevada, Mo.—Jas. M. Clack, City Engr., writes that bids will be received until Sept. 12 for constructing 12,450 ft. 12-in. vitr. pipe sewer, 8,750 ft. 12-in. and 800 ft. 10-in., with manholes, branches, etc.

St. Joseph, Mo.—Press reports state that bids will be received until Sept. 1 by the Bd. Pub. Wks. for building South St., Joseph and Wyatt Park sewers. Bids to be on concrete and reinforced concrete construction. Wm. H. Floyd, Jr., City. Engr.

**Trenton, Mo.*—Rackliffe & Gibson, of St. Joseph, are stated to have secured the contract for constructing the sewer in Dist. 3 for about $4,000.

Glendive, Mont.—See "Water."

Brooklyn, N. Y.—Plans are stated to have been prepared and a recommendation made for the repair of the 120-in. trunk sewer at the foot of 49th St., Bay Ridge. Henry R. Asserson, Ch. Engr. Bureau of Sewers of Brooklyn Boro.

Bids will be received until Sept. 13 by Martin W. Littleton, Boro. Pres., for furnishing materials and constructing sewers in portions of 6 streets. Engineer's estimate: 7,640 lin. ft. 15 and 12-in. pipe sewer; 78 manholes; 544 cu. yds. concrete cradle; 45,300 ft. B. M. foundation planking; 110,000 ft. B. & M. sheeting and bracing, etc., Boro. Brooklyn.

Bound Brook, N. J.—Bids will be received until Aug. 29 by the Mayor and Council for constructing sewers in portions of John St. and Maple Ave. Engineer's approximate estimate: 1,076 lin. ft. vitr. pipe; 6 manholes, complete, and 2 Miller flush tanks, complete and connected. Joshua Doughty, Boro. Engr., Somerville; Fred. N. Voorhees, Boro. Clk.

Long Island City, L. I., N. Y.—Bids willl be received until Aug. 31 by Jos. Cassidy, Pres. Boro. Queens, for constructing sewers and appurtenances on portions of Oak and 17th Sts., Cypress and Queens Aves., and the construction of 14 catch basins also the construction of a sewage disposal plant in connection therewith, all of the same being situated in Ingleside, 3d Ward, Boro. Queens. Engineer's estimate: 725 lin. ft. 9-ft. sewer, including portal at outlet; 1,580 lin. ft. 8 ft. 9 in., 1,007 lin. ft. 8 ft., 774 lin. ft. 6 ft. 6 in., 810 lin. ft. 6 ft., 1,830 lin. ft. 5 ft. 3 in., 245 lin. ft. 2 ft. 6 in. sewers; 350 lin. ft. 12-in. culvert pipe; 14 receiving basins and 43 manholes, complete; 14 domes; 7,000 lin. ft. 12-in. pipe subdrain; 800,000 ft. B. M. timber for found., furnished and laid; 650,000 ft. B. M. timber for bracing and sheet piling; 20,000 lin. ft. piles; 1,000 cu. yds. rock excav. and removed, and 100 cu. yds. concrete, exclusive of concrete, as shown on plan; also same date for constructing sewers and appurtenances in portions of 5 streets. Engineer's estimate: 8,945 lin. ft. 18, 15 and 12-in. vitr. salt-glazed or cement concrete sewer pipe; 490 lin. ft. 12-in. vitr. salt-glazed or cement concrete culvert pipe; 12,844 lin. ft. 6-in. vitr. salt-glazed or cement concrete sewer pipe, as risers for house connections; 61 manholes and 17 receiving basins, complete; 23,500 ft. B. M. timber for found, furnished and laid; 135,000 ft. B. M. timber for bracing and piling, and 200 cu. yds. rock excav. and removed, Boro. Queens.

**Troy, N. Y.*—M. H. Cavanaugh is stated to have secured the contract for constructing a sewer in Stow Ave. (bids opened Aug. 15) for $3,400.

Buffalo, N. Y.—Bids will be received by the Dept. Pub. Wks. (Francis G. Ward, Comr.) until Sept. 1 for constructing a 30, 24, 18, 15, 12 and 10-in. tile sewer in portions of several streets; also 24 and 10-in. c.-i. pipe sewer in Roseville, Hydraulic and Seneca Sts.

Marietta, O.—See "Water."

Columbus, O.—The State Bd. of Health is stated to have on Aug. 16 approved plans for a sewage disposal plant for Columbus.

Cincinnati, O.—Bids will be received until Sept. 1 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and constructing sewers in a portion of Morris Pl.

Willoughby, O.—Bids will be received until Sept. 11, by C. C. Jenkins, Village Clk., for $4,000 bonds issued to construct a storm sewer in Erie St.

Delaware, O.—It is stated that bids will be received until Sept. 7 by the Bd. Pub. Service (F. D. King, Clk.), for constructing a sewer pipe or tile drain across Webb and Lake Sts.

Coshocton, O.—It is stated that bids will be received until Aug. 31 by the Bd. Pub. Service (W. S. Hutchinson, Clk.), for constructing an 8-in. sewer in various streets.

Oklahoma City, Okla. Ter.—See "Water."

Shawnee, Okla. Ter.—See "Schools."

Portland, Ore.—City Engr. Wanzer is stated to have completed plans for the construction of the Brooklyn sewer; probable cost $200,000.

North York, Pa.—C. I. Taylor, Secy. of Council, writes that bids will be received about Sept. 1 for the construction of sewers, part brick and part of extension terra cotta; probable cost, $2,600. G. B. Zech, Chmn. Highway Com.

**Mt. Oliver, Pa.*—Engrs. Rankin & Hengst, 301 Smithfield St., Pittsburg, write that the contract for constructing 3,375 ft. of sewers in Mt. Oliver for the Rankin Improv. Co., has been awarded to W. H. Baughman, 1711 Farmers' Bank Bldg.. Pittsburg.

Chattanooga, Tenn.—Surveys for the 9th Ward sewerage system have been completed and the engineers are at work on plants for a separate system, which will include the whole of the Ft. Wood section. Bids will probably be asked on both systems within a few weeks.

San Anonio, Tex.—See "Paving and Roadmaking."

San Antonio, Tex.—District No. 1 has voted $23,600 bonds for sanitary sewers. John D. Rullman, City Engr.

Ft. Worth, Tex.—John B. Hawley, City Engr., has completed plans for sewers, to be constructed in the 5th, 6th, 7th, and 8th Wards, and bids for the same will be received Sept. 15. The work includes about 25 miles of sewers.

**Seattle, Wash.*—Geo. W. Walker, of Seattle, has received the contract for constructing sewers in 10th Ave. N. and 7th Ave. N., for $8,609.

Spokane, Wash.—The following are reported to be the bids opened on Aug. 9 by the Bd. of Pub. Wks. for the construction of a trunk sewer in the 4th Ward: J. A. Clark, $21,000; Jas. C. Broad, $17,965, and Peter Costello, $17,200.

Wenatchee, Wash.—The City Council is reported to have passed an ordinance providing for the construction of sewers in Districts Nos. 1 and 2.

Harrington, Wash.—The City Council is reported to have authorized its engineer to make surveys for a sewerage system.

Prosser, Wash.—The Public Improv. Committee of City Council, consisting of Aldermen McNeill, Kemp and Harris, are reported to be investigating the question of constructing a sewerage system, the report to be submitted the first week in Sept.

Fairmont, W. Va.—The Council is reported to have adopted the plans prepared three years ago by City Engr. J. M. Prickett for a sewerage system, to cost about $30,000.

Monterey, Mex.—See "Water."

Hamilton, Ont.—City Engineer Barrow is stated to have submitted to the Sewer Com. two plans, one to overcome the difficulty caused by flooding, in which he proposes to establish a system to carry away the storm waters at an estimated cost of $21,166; the other to establish a sewage system in the new district at an estimated cost of $27,793, including $9,747 for service sewers to be built under the local improvement plan. He proposes to build a trunk sewer on Trolley St., with an outlet at Stipe's Inlet, where a disposal works will be established; also a number of other sewers.

Winnipeg, Man.—Bids will be received until Sept. 23 by J. H. Agnew, Provincial Treas., for $150,000 drainage bonds.

St. Catherines, Ont.—Bids will be received until Sept. 4 by W. A. Mittleberger, Treas., for $30,000 sewerage and drainage bonds.

Sudbury, Ont.—See "Water."

BRIDGES.

Notes Arranged Alphabetically by States.

Colusa, Cal.—It is stated that bids will be received until Sept. 6 by the Bd. Superv. for constructing 2 steel bridges across Stone Corral Creek.

**Bridgeport, Conn.*—The contract for construction of a reinforced arch bridge over Ash Creek, between Bridgeport and Fairfield (bids opened Aug. 10) has been awarded to Standish Stone Corporation, of Bridgeport, for $27,856. W. W. Starr, City Surveyor; E. T. Buckingham, City Clk.

Washington, D. C.—Bids will be received until Sept. 16 by the Comrs. D. C., for constructing a concrete bridge at 16th St., across Piney Branch, as advertised in The Engineering Record.

**Chicago, Ill.*—Local press reports state that contracts for constructing the North Ave. Bridge were awarded on Aug. 16 as follows: Superstructure to Roemheld & Gallery, 719 Chamber of Commerce Bldg., $112,000, and substructure to Jackson & Corbett, 1132 Rookery Bldg., for $81,000. For detail bids received for this bridge see issue of The Engineering Record of May 6.

Springfield, Ill.—It is reported that bids will be received until Sept. 4 by the Park Bd. (Arthur Hay, Secy.) for reconstructing 2 reinforced concrete bridges on pile foundations in Washington Park.

Richmond, Ind.—The South Side Improvement Assoc. is stated to have petitioned the Council for a bridge over the Whitewater River. It is estimated that the bridge will cost $100,000. The structure will be 1,000 ft. long.

Indianapolis, Ind.—Bids will be received until Aug. 29 by the Co. Comrs. for constructing a bridge across Eagle Creek in Wayne Township, a culvert over ditch in Franklin Township, and a bridge across Swarm's Branch in Lawrence Township. Cyrus J. Clark, Co. Aud.

Des Moines, Ia.—See "Railroads."

Damariscotta, Me.—E. R. Castner, Town Clk., writes that it is proposed to construct a steel bridge over Damariscotta River to connect with Newcastle; cost $15,000. Address, E. F. Metcalf, of Damariscotta.

**Concord, Mass.*—The following are the bids opened on Aug. 17 by the Massachusetts Highway Comn., Boston, for constructing a steel arch bridge over Assabet River on the State highway in Concord: W. Shea & Son, Quincy, $15,300; D. E. Lynch, Dorchester, $13,500; R. F. Hudson, Melrose, $9,814; H. A. Hanscom Co., Boston, $9,750, and Globe Constr. Co., Boston, $9,520 (awarded contract).

Pittsfield, Mass.—Bids will be received until 2 p. m., Aug. 30, for a plate-girder bridge across 2d St., over tracks of the B. & A. R. R. Co., N. Y. C. & H. R. R., lessee. The bridge has a span of 72.2 ft. c. to c. of bearings. It is to have 28 ft. of roadway and two 5-ft. sidewalks. The abutments and retaining walls will be built for the same and the work will call for about 1,650 cu. yds. masonry and 1,628 cu. yds. excav. The work is called for in two separate contracts. A. A. Borbes, City Engr.

Bay City, Mich.—See "Paving and Roadmaking."

Neosho, Mo.—It is stated that bids will be received until Sept. 4 by John M. Sherwood, Bridge Comr., for constructing a 2-span steel bridge over Indian River, to have a total length of 148 ft.

Morehead City, N. C.—See "Railroads."

Jamestown, N. D.—Bids will be received until Sept. 4 by Andrew Blewett, Co. Aud., for constructing a steel pile bridge across James River to replace "Foster Bridge."

**Minot, N. D.*—The County Comrs. are stated to have awarded the contract for constructing a bridge over De Lacs Lake to the Northwestern Bridge Co., of Minneapolis, Minn., for $180,500. (Bids opened July 9.)

Norwalk, O.—Bids will be received until Sept. 7 by the Co. Comrs. (J. H. Beattie, Clk.) for repairing the substructure and constructing a new superstructure for bridge across Huron River in Peru Township. Bidders are to furnish plans for the superstructure.

Chillicothe, O.—Bids will be received until Sept. 11 by Charles H. Pinto, Co. Aud., for furnishing material and constructing 2 mild steel superstructures for 2 single span highway bridges, 1 to be constructed across Salt Creek, in Jefferson Township, to be 199 ft. long, and the other over Herod's Creek, 1 mile west of Austin, in Concord Township, to be 79 ft. long.

Columbus, O.—Bids will be received until Sept. 14 by the Co. Comrs. for furnishing material and reflooring the roadway of the bridge across Scioto River at Mound St., Columbus. L. E. Jones, Co. Aud.

Delaware, O.—It is stated that bids will be received until Sept. 7 by the Bd. Pub. Service (F. . King, Clk.) for constructing a bridge across the Delaware River, at Sandusky St.

Cordell, Okla. Ter.—It is stated that bids will be received until Sept. 1 by W. B. Tharrington, Co. Clerk, for constructing a steel bridge 100 ft. long over the Washita River.

Albany, Ore.—It is stated that bids will be received by the Co. Comrs. until Sept 8 for constructing a wagon bridge across Santiam River. B. M. Payne, Co. Clk.

Wilkinsburg, Pa.—See "Railroads."

Spartansburg, S. C.—It is stated that bids will be received until Aug. 29 by the Co. Comrs., F. C. West, Clk., for constructing a bridge across Pacolet River.

**Ft. Pierre, S. D.*—The contract for constructing a steel bridge 260 ft. long over Bad River is stated to have been awarded (bids opened Aug. 5) to Des Moines Bridge & Iron Works, of Des Moines, Ia., for $6,473.

Benton, Tenn.—The County Court is stated to have decided to construct bridges as follows: One over the Conasarga, one at Ducktown, one at Reliance and 3 near Benton; probable cost of improvement $40,000.

**Pasco, Wash.*—E. J. Pearson, of St. Paul, Minn., Ch. Engr. Northern Pacific Ry. Co., writes that the contract has been awarded for the construction of the steel bridge across Columbia River at Pasco, and the work of erection is now under way.

La Crosse, Wis.—The construction of a bridge over Black River at the southern end of the causeway is reported under consideration; probable cost $40,000.

San Juan, Porto Rico.—Alternate bids will be received until Sept. 30 by J. J. Jimenez, Supt. Pub. Wks., for furnishing and erecting or for furnishing only on the dock at San Juan, a steel riveted lenticular or double bowstring through truss highway bridge, 100 ft. span; also on same date alternate bids for furnishing and erecting or for furnishing only on the dock at San Juan a steel riveted through truss highway bridge, 266 ft. span, both advertised in The Engineering Record.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—It is stated that bids will be received until Sept. 5 by C. W. Hicks, City Clk., for paving and grading Main St. and Brewery Ave.

Gadsden, Ala.—See "Water."

Hamden, Conn.—Bids will be received until Aug. 29 by the Bd. Selectmen (Burton D. Potter, Chmn.) for macadamizing a section of road in this town. A. Wm. Sperry, Engr., 82 Church St., New Haven.

**Items marked thus give the names of parties awarded contracts.*

Wilmington, Del.—Bids will be received until Sept. 5 by Francis A. Price, State Highway Comr., 1009½ Market St., for building a macadam road known as "New" road, in all a distance of about 1½ miles.

**Wilmington, Del.*—J. Merrick Horn has secured the contract for 7,500 sq. yds. bitulithic pavement (bids opened Aug. 17 by the Street and Sewer Dept.) at $1.95 per sq. yd.

Chicago, Ill.—The Finance Com. is stated to have voted to appropriate $15,000 to complete preliminary survey for widening Halsted St. to 100 ft. from south branch to north branch of Chicago River. The improvement will cost approximately $2,500,000.

Chicago, Ill.—Bids will be received by the Bd. Local Improv., Aug. 30 (And. M. Lynch, Pres.) for improving portions of numerous streets by grading, curbing and paving with granite blocks, vitr. brick, asphalt, limestone and slag.

**Bloomington, Ill.*—The following are the bids opened Aug. 11 by the Bd. of Local Improv. for paving (*a*) 16,144 sq. yds. brick paving; (*b*) 11,451 lin. ft. combined curb and gutter: O. W. Dunlap, Bloomington, *a* $1.59, *b* 58 cts.; Crescent Stone Co., *a* $1.57, *b* 56 cts. (awarded contract).

Rock Island, Ill.—The following bids are stated to have been opened Aug. 11 for paving with asphalt on 21st St.: McCarthy Improv. Co., $1.76½ per sq. yd., and Thos. J. Peters Co., of Chicago, $1.87 per sq. yd.; probable cost of improvement $8,000.

**Knox, Ind.*—Lee M. Ransbottom, Co. Aud., writes that Jacob Keller, of North Judson, Ind., has secured the contract to construct 6 gravel roads, in all about 117,963 ft. (bids opened Aug. 8) at $19,900.

Greencastle, Ind.—Bids will be received until Sept. 4 by the Bd. Co. Comrs. (Samuel H. Judy, Chmn.) for improving 11,466 ft. macadamized road in Greencastle Township.

Sullivan, Ind.—Bids will be received until Sept. 1 by the Bd. Co. Comrs, (Wiley Gambill, Chmn.) for constructing 3 gravel or macadamized roads in Curry Township. E. E. Russel, Co. Aud.

**Marion, Ind.*—The Comrs. of Grant and Huntington Counties are stated to have awarded the contract for constructing the Holmes gravel road to Oren J. Simmons, of Marion, for $7,770.

Brownstown, Ind.—It is reported that bids are wanted until Sept. 5 for constructing gravel roads in this County; H. W. Wacker, Co. Aud.

Indianapolis, Ind.—Bids will be received until Sept. 1 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for grading and paving with brick a portion of an alley; graveling, rolling the roadway and paving the sidewalks with cement on a portion of Columbia Ave., and paving the sidewalk with cement on a portion of Temple Ave.

**Manchester, Ia.*—The contract was awarded Aug. 15 to M. Ford, of Cedar Rapids, for paving portions of Franklin and Main Sts. with Galesburg blocks at $1.68 per sq. yd. and cement curb, 5 x 24, 29 cts. per lin. ft. Kimball Engr. Co., Davenport, Ia., engrs. in charge.

**Council Bluffs, Ia.*—E. A. Wickham, of Council Bluffs, has secured the contract for brick paving (bids opened Aug. 7) for about $100,000. There will be about 25,000 sq. yds. double course brick Galesburg top and 25,000 yds. concrete base and Galesburg top.

Iola, Kan.—Bids will be received until Sept. 7 at the office of Geo. Myers, City Clk., for grading, curbing and paving South St. Approximate quantities: 13,477 sq. yds. vitr. brick; 6,700 lin. ft. curbing header; 5,500 cu. yds. earth excav., etc.

Towson, Md.—Bids will be received until Aug. 31 by the Highway Comrs. for grading and macadamizing about 2 miles of the public highway.

Lowell, Mass.—See "Sewerage and Sewage Disposal."

Everett, Mass.—Bids are about to be asked for laying 8,000 sq. yds. bitulithic pavement on Main St., according to plans prepared by C. Harrison, City Engr.

Ft. Warren, Mass.—The following are the bids opened on Aug. 19 by Maj. John Baxter, Q. M., U. S. A., Boston, for grading and concrete walks at Ft. Warren: Jos. J. Moebs, Quincy, $3,497; J. J. Callahan, Atlantic, $4,400; Michael Salerno, Boston, Mass., $9,228, and Frank W. McCusker, Waltham, $3,300 (walks only).

Boston, Mass.—The following are the bids opened on Aug. 21 by the Metropolitan Park Comn., Boston, Mass., for grading the Quincy Shore reservation, from Atlantic St. to National Soldiers' Home, Quincy (bidders of Boston, unless otherwise mentioned): T. E. Ruggles, $220,200; Globe Constr. Co., $139,525; Jones & Meehan, $137,700; Eastern Dredging Co., $120,100; Coleman Bros., $104,900; W. H. Ellis, $102,875; T. H. Gill, $91,875; Rowe & Perini, South Framingham, $78,375, and Newell & Snowling, Clinton, $65,700.

*The following contracts have been awarded by the Massachusetts Highway Comn. for constructing sections of State Highway in the following towns (bids opened Aug. 17): Pittsfield, to O. T. Benedict, of Pittsfield, for $2,183; Westport, to Lane Quarry Co., of Hingham, for $2,350; Charlton, to R. F. Hudson, of Melrose, for $2,938, and Quincy, to Lane Quarry Co., of Hingham, for $2,860.

Barnstable, Mass.—Bids will be received until Sept. 1 by the Bd. Selectmen (Edgar W. Lovell, Chmn.) at the office of the Highway Comn., Boston, for constructing 2 adjoining sections of macadam road, each about 8,900 ft. long, in this town.

Fall River, Mass.—The Bd. of Aldermen is stated to have authorized the issue of $50,000 bonds for highway improvements and street paving.

**Bay City, Mich.*—The Bd. Pub. Wks. is stated to have awarded the contract for paving with brick Washington St. Viaduct to W. J. Meagher, at $6,567.

Lansing, Mich.—Bids will be received by the City Clerk until 8 p. m., Aug. 28, for paving Ottawa St., 15,233 sq. yds. H. A. Collar, City Engr.

Detroit, Mich.—The following are stated to have been the lowest bids received Aug. 17 for paving: Commonwealth St., with asphalt, Barber Asphalt Co., $19,396; Rivard St., with Medina block, Michigan Contr. Co., $7,550; Cleveland St., with cedar, McVicar Constr. Co., $5,379; Dubois St., with cedar, Robt. Conway & Co., $14,435; Wesson St., with cedar, Fred Porath & Son, $12,839; Hastings St., with brick, Julius Porath, $8,340; Clinton and Catherine Sts., with block brick, Currie & Conn, $4,761 and $5,238, respectively; Wesson St., with cedar, Ferdinand Porath, $12,879.

Cincinnati, O.—Bids were opened on Aug. 14 by the Bd. of Public Service for the improvement of a portion of Warsaw Ave. by grading, curbing and paving with bitulithic; the following are the totals, also unit prices on some of the items: (*a*) Henkel & Sullivan, $77,673, (*b*) Warren Bros. Co., $78,227, (*e*) Kircher Constr. Co. (informal).

	a	*b*	*c*
8,300 lin. ft. 5-in. granite curb	$1.28	$1.25	$1.30
240 lin. ft. 5-in. granite circular curb	2.00	2.00	2.00
28,350 cu. yds. excav.	.42	.40	..
12,900 sq. yds. finished grading and rolling	.10	.08	.10
200 cu. yds. extra stone	1.50	2.50	2.00
2,800 cu. yds. crushed stone foundation and rolling	2.20	2.50	2.25
50 cu. yds. Portland cement concrete	6.00	4.50	6.00
16,800 sq. yds. pouring foundation with bitum.	.24	.25	.25
16,800 sq. yds. wearing surface and binder	1.58	1.55	1.60
16,800 sq. yds. bituminous flush coat	.14	.13	.15
16,800 sq. yds. stone chips, finished surface	.10	.12	.10
16,800 sq. yds. patent rights	.25	.25	.25
350 cu. yds. masonry (rubble coursed)	4.50	4.00	5.00
40 cu. yds. masonry (brick)	7.00	12.00	8.00
400 lin. ft. 12-in. drain pipe	1.00	1.25	1.00
8,300 lin. ft. 4-in. drain pipe	.14	.17	.15
5,175 lbs. castings	.04	.05	.05
1,200 sq. ft. limestone coping	.50	.75	.50
950 sq. yds. granite paving	3.50	3.60	3.60

St. Paul, Minn.—The Bd. of Pub. Wks. is stated to have reported favorably on the paving of Fillmore Ave., at an estimated cost of about $7,000.

Crookston, Minn.—Bids will be received until Sept. 12 for paving with 3½ or 4-in. creosoted Norway pine blocks, curbing and constructing drain tile in a portion of E. Robert St., as advertised in The Engineering Record.

Laconia, N. H.—The City Council has appropriated $5,000 for paving on Elm and Water Sts. Work will be done as soon as plans can be completed. F. G. Berry, City Engr.

South Orange, N. J.—Bids will be received until Sept. 11 by the Road Com. of South Orange Township at Maplewood (H. Stacy Smith, Chmn.) for constructing about 2,700 ft. concrete sidewalks on Maplewood Ave., Baker St. and Ridgewood Road; L. P. Taylor, Engr., South Orange.

Bayonne, N. J.—Bids will be received until Sept. 5 by the City Council for paving about 1,547 sq. yds. with brick on a portion of Dodge St., as advertised in The Engineering Record.

**Duluth, Minn.*—The following are the bids opened on Aug. 14 by the Bd. of Pub. Wks. for paving Mesaba and Piedmont Aves. and W. Superior St., 8th to 25th Ave., West: (*a*) Fitzgerald & Norris, Duluth; (*b*) P. McDonnell, Duluth; (*c*) Saug & Preston, Duluth; (*d*) Hugh Steele, Duluth (awarded contract for tar macadam 6-in. crushed rock foundation); (*e*) Geo. R. King, Duluth; (*f*) F. A. Malette, Minneapolis; (*g*) Barber Asphalt Paving Co.:

	a	*b*	*c*	**d*	*e*	*f*	*g*
50,820 sq. yds. old pav't removed	$0.12	$0.10	$0.10	$0.06	$0.11	$0.11	$0.10
1,500 cu. yds. earth excav.	.10	.50	.50	.30	.45	.45	.10
200 cu. yds. earth in foundation	1.00	1.00	.60	.80	.55	1.12	1.00
40 cu. yds. rock in foundation	7.00	9.00	5.00	5.00	5.50	6.50	5.00
110 tile cross drains	10.00	14.00	7.00	6.00	15.40	6.30	15.00
14,865 lin. ft. curb reset in concrete	.60	.50	.55	.70	.52	.45	.60
150 lin. ft. new granite curb in concrete	1.70	1.50	1.50	1.00	1.25	1.35	1.50
1,000 cu. yds. crushed rock	1.00	2.50	2.25	1.50	2.00	1.79	...
13,850 sq. yds. sandstone pav't bet. car tracks, tar & gravel fill	2.25	2.15	2.45	2.50	2.45	...	...
36,970 sq. yds. sandstone pav't, outside car t'ks, tar & gravel fill	2.12	2.15	2.20	2.25	2.20	...	...
9 No. 5 catch basins	12.00	30.00	30.00	30.00	30.00	33.50	30.00
32 intakes, rebuilt	12.00	20.00	15.00	8.00	20.00	13.50	10.00
620 lin. ft. 10-in. pipe	.45	.75	.40	.40	.55	.40	.40
9 No. 2 intakes	33.00	40.00	35.00	40.00	35.00	39.25	40.00
160 lin. ft. 12-in. concrete sewer	1.10	1.00	1.50	1.00	1.00	1.29	1.00
80 lin. ft. 26-in. concrete sewer	3.00	1.75	2.50	1.80	1.50	1.85	1.50
500 lin. ft. 3-in. tile	.10	.25	.20	.10	.25	.03½	.10
13,850 sq. yds. tar macadam bet. tracks	1.70	1.50	1.95	1.43	2.00	1.62	...
36,970 sq. yds. tar macadam, outside tracks	1.50	1.50	1.55	1.14	1.55	1.42	...
1,000 cu. yds. crushed rock	1.00	2.50	2.50	2.00	2.00	...	1.60
13,850 sq. yds. tar macadam on 5-in. concrete, bet. tracks	2.15	1.60	...	1.85	1.92	...	...
36,970 sq. yds. tar macadam on 5-in. concrete, outside tracks.	2.15	1.60	...	1.41	1.92	...	...
36,970 sq. yds. sandstone pav't, sand filler	2.20	1.95	2.05	2.07	2.12	...	...
13,850 sq. yds. telford macadam bet. tracks	...	1.10	1.30	1.10	1.30	...	...
36,970 sq. yds. telford macadam outside tracks	...	1.10	1.10	.95	1.10	...	...
27 manhole rings and asphalt filled covers	11.00	15.00	15.00	12.00	11.00	17.35	15.00
13,850 sq. yds. asphalt pav't, bet. tracks	...	1.78	...	...	...	...	2.47
36,970 sq. yds. asphalt pav't, outside tracks	...	1.78	...	...	...	...	1.97
Totals Telford macadam	...	74,361	78,265	68,093	77,240	...	...
" Tar macadam, 6-in. crushed rock foundation	109,263	96,884	105,753	*80,798	97,574	93,233	...
" Tar macadam, 5-in. concrete base	128,005	101,966	141,327	96,597	118,495	...	...
" Asphalt	...	111,349	...	...	...	...	126,999
" Sandstone, tar and gravel fill	129,075	129,512	134,692	135,870	135,444	...	...
" Sandstone with sand fill, outside railway	132,033	122,118	129,147	129,216	132,486	...	...

Union, N. J.—It is stated that bids will be received until Aug. 28 by the Bd. of Council for paving and laying sidewalks on both sides of Fourth St.

New York, N. Y.—The following are the bids opened on Aug. 17 by the Comrs. of Parks, for 1,410 lin. ft. 5-in. bluestone curb set on concrete foundation and 5,500 sq. yds. granite block on reinforced concrete foundation: The Matthew Baird Contr. Co., 433 E. 93d St., $18,546; Cunningham & Kearns, 305 E. 86th St., $19,615; Bart Dunn, 253 E. 68th St., $20,906; Phoenix Constr. & Supply Co., 41 Park Row, $17,333, and F. V. Smith Contr. Co., 125th St. and Lexington Ave., $21,210.

**Brooklyn, N. Y.*—The following are the bids opened on Aug. 16 by Martin W. Littleton, Pres. Brooklyn Boro., for regulating and paving with asphalt block, on concrete foundation, Bedford Ave., from Eastern Parkway to Malbone St.: (*a*) 11,550 sq. yds. asphalt block; (*b*) 1,440 cu. yds. concrete; (*c*) totals: Interstate Paving Co., Brooklyn, *a* $1.30, *b* $4.50, *c* $21.495; Kelly Asphalt Block Co., Brooklyn, *a* $1.39, *b* $4.49, *c* $22,520; Barber Asphalt Co., New York, N. Y., *a* $1.55, *b* $3.90, *c* $23,518; Hastings Paving Co., 25 Broad St., New York, N. Y., *a* $1.34, *b* $4, *c* $21,237 (awarded contract).

*Bids were opened same time and place for paving Church Ave., from Flatbush Ave. to New York Ave., with asphalt: (*a*) 10,160 sq. yds. asphalt, (*b*) 1,420 cu. yds. concrete, (*c*) total: Brooklyn Alcatraz Co., Brooklyn, *a* 80 cts., *b* $5, *c* $15,228; Cranford Co., Brooklyn, *a* 85 cts., *b* $4.20, *c* $14,600; Uvalde Asphalt Co., 1 B'way, New York, N. Y., *a* 75 cts., *b* $4.10, *c* $13,442 (awarded contract); Barber Asphalt Co., New York, N. Y., *a* 95 cts., *b* $3.81, *c* $15,062.

*Bids were opened same time and place for curbing and laying cement sidewalks on 5th Ave., (*a*) 8,995 lin. ft. new curb; (*b*) 43,940 sq. ft. cement sidewalk; (*c*) total: (bidders of Brooklyn, unless otherwise mentioned): Chas. Cranford, *a* $1.37, *b* 14½ cts., *c* $18,694; W. K. Putnam, 5121 3d Ave., Brooklyn, *a* $1.04, *b* 14¾ cts., *c* $15,836 (awarded contract); Norton & Gorman, *a* $1.17, *b* 20 cts., *c* $19,312; Uvalde Asphalt Co., New York, N. Y., *a* $1.07, *b* 15¾ cts., *c* $16,545; Hickey, MacFarland Co., *a* $1.03, *b* 15 cts., *c* $15,855; Mangieri Co., New York, N. Y., *a* $1.29, *b* 15 cts., *c* $18,195; N. Schneider Sons, *a* $1.30, *b* 14 cts., *c* $17,845.

*D. Douglass, 122 Logan St., Brooklyn, secured the contract for cement walks on Rockaway Ave. (bids opened Aug. 16) as follows: 4,691 lin. ft. new curb, $1.02; 16,740 cu. yds. earth excav., 23 cts.; 28,472 sq. ft. cement sidewalks, 14 cts.; total, $12,621. The other bids were: Bedford Constr. Co., $13,862; Norton & Gorman, $17,862, and Chas. Cranford, $14,285.

Brooklyn, N. Y.—Bids will be received until Sept. 7 by Martin W. Littleton, Boro. Pres., for regulating, grading, curbing, paving and laying sidewalks on portions of several streets; engineer's estimate: 11,372 sq. yds. asphalt; 5,947 lin. ft. new curb; 6,516 lin. ft. new curb., to be set in concrete; 46,225 sq. ft. cement sidewalks; 2,004 cu. yds. concrete; 8,732 cu. yds. earth excav., etc.

Long Island City, L. I., N. Y.—Bids will be received until Aug. 31 by Jos. Cassidy, Pres. Boro. Queens, for regulating, grading, curbing and laying sidewalks and cross walks on portions of 5 streets. Engineer's estimate: 54,400 sq. ft. cement sidewalks; 11,180 lin. ft. con. curb; 2,930 sq. ft. new bluestone bridgestone, and 21,200 cu. yds. earth excav.; also Aug. 31 (extension of date), for regulating, grading, curbing and laying sidewalks and cross walks on portions of several streets. Engineer's estimate: 39,000 cu. yds. earth excav.; 15,600 lin. ft. concrete curb; 77,000 sq. ft. cement sidewalks and 8,250 sq. ft. new bluestone bridging; also for regulating, grading and repaving with macadam the roadway of Strong's causeway from Flushing Creek to North Hempstead. Engineer's estimate, 8,900 sq. yds. macadam.

**Atchison, Kan.*—The following are the bids opened on Aug. 18 for repaving Kansas Ave. with one course of vitrified brick on old concrete foundation, brick to be grouted with cement grout: (*a*) O. E. Seip, Atchison, $19,717; (*b*) Atchison Paving Brick Co., Atchison, $19,497 (awarded contract):

	a	**b*
18,523 sq. yds. removing old cedar blocks	$0.05	$0.10
1,619 lin. ft. readjusting curb	.15	.10
1,157 lin. ft. new cement curb, 5½ x 20 in.	.37	.40
18,404 sq. yds. paving	.96	.90
5 catch basins	20.00	20.00
500 lin ft. sewer pipe	.65	.65

**Items marked thus give the names of parties awarded contracts.*

**Rochester, N. Y.*—The contract for paving with Metropolitan brick on Mead St. is stated to have been awarded to F. A. Brotsch & Son, 826 Clinton Ave., S., for $5,074.

Johnstown, N. Y.—J. F. Campbell, City Engr., writes that at a meeting of Common Council, Aug. 21, the city declared its intention to pave with asphalt block Perry St., from 1st Ave. to Madison St.; S. Market St., from Main to Montgomery St., and N. Market St., from Washington to Main St.; also W. Montgomery St., from Melcher St. to Meadow St., with macadam. On Sept. 4 further action will probably be taken toward adopting plans and specifications. He further states that no bids have been asked for any paving so far this year.

Troy, N. Y.—Bids will be received by the Bd. Contract and Supply (Jas. M. Riley, Clk.) until Sept. 1, for furnishing materials, regulating, grading, curbing and paving with vitr. brick a portion of 13th St.

**Ilion, N. Y.*—Alonzo Schaupp is stated to have received the contract for macadamizing portions of E. Main, 1st and 2d Sts., at 76 cts. per sq. yd.

Herkimer, N. Y.—It is stated that bids will be received until Aug. 28, by the Bd. Trus. for paving on Main St. with either sheet asphalt, vitrified brick, block standstone or bitulithic. T. C. Murray, Village Clk.

**Greensboro, N. C.*—T. A. Hunter, Chmn. Street. Com., writes that the Southern Constr. Co., of Norfolk, Va., has secured the contract for paving Elm St. about 19,000 sq. yds. (bids opened Aug. 17) at $2.08 per sq. yd., including excav. 5-in. concrete and brick, with pitch or asphalt filler.

East Palestine, O.—It is reported that this village will receive bids on Sept. 4 for 14,111 sq. yds. of brick paving.

Dayton, O.—Bids will be received by the Bd. Pub. Service until Sept. 6 for about 2,700 sq. yds. brick paving. F. M. Turner, City, Engr.

Jackson, O.—It is stated that bids will be received until Aug. 31 by W. J. Snumate, Co. Aud., for constructing about ½ mile of turnpike road.

Willoughby, O.—Bids will be received until Sept. 18 for furnishing material, grading, paving with brick and curbing a portion of Erie St. Bids will also be received on same date for $5,000 Erie St. improvement bonds. C. C. Jenkins, Village Clk.

Dover, O.—Bids will be received by the Bd. Pub. Service (H. F. Eppens, Clk.) until Aug. 30, for furnishing materials, grading, curbing and paving the Public Sq. and a portion of 3d St.

Cincinnati, O.—Bids will be received until Sept. 1 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material, grading, setting granite curb, and paving the roadway with brick on a portion of Ferguson Alley.

Toledo, O.—Bids will be received until Aug. 31 by the Bd. Co. Comrs., for repairing the Holland and Jerusalem stone roads, in all a distance of 4 miles. D. T. Davies, Jr., Co. Aud.

Bids will be received until Sept. 5 by the Bd. Pub. Service (Harry S. Jones Secy.) for furnishing materials and improving portions of Felt St. and Parkwood Ave. by paving with either asphalt, Medina asphalt, creosoted wood or vitr. blocks.

*Garrigan Bros., Valentine Bldg., are stated to have received the contract for paving portions of Consaul and Columbus Sts., for $11,467 and $7,199, respectively.

Jersey City, O.—Bids will be received until Sept. 18 by A. H. Whitacre, Village Clk., for $5,350 bonds for improving Main St.

**Portland, Ore.*—Contracts for 14,425 sq. yds. of bitulithic in 2d St., and 13,021 sq. yds. in Couch St., have been awarded to the Warren Constr. Co., of Portland.

Harrisburg, Pa.—It is stated that bids will be received until Sept. 2 by Jos. W. Hunter, State Highway Comr., for constructing 11,250 ft. of road in E. Vincent Township, and 5,445 ft. of road in Westtown Township, Chester County.

Mercer, Pa.—Bids are wanted until Sept. 6 for furnishing 400,000 vitr. fireclay paving brick; also for constructing 4,700 ft. cement curbing. J. M. Campbell, City Clk.

Bellevue, Pa.—Bids will be received by J. M. Simeral, Clk. of Council, 69 Harrison Ave., until Sept. 5, for grading, curbing and paving portions of Sherman and Woodlawn Aves.; grading and partially curbing Starr Ave. John McBride, Boro. Engr., 46 Fidelity Bldg., Pittsburg.

Lancaster, Pa.—Bids will be received until Sept. 4 by the Street Com. of City Councils, at the office of the City Comp., for removing about 7,150 sq. yds. Belgian blocks, and for the substitution therefor of asphalt sheeting, wooden blocks, or other noiseless paving material on portions of Center Sq. and N. Queen St. J. H. Rathfon, City Comp.

Altoona, Pa.—Ordinances are being prepared for a large amount of vitrified brick paving on concrete foundation, the city paying one-third of the cost, the remainder assessed upon the abutting properties. Nearly 15,000 sq. yds. will be laid this year. Harvey Linton, City Engr.

Carrick, Pa.—Bids will be received until Aug. 28 by the Street Com., for grading, curbing and paving about 9,600 ft. Brownsville Road with vitr. block. Wm. McClurg Donelly, Boro. Engr., 1109 House Bldg., Pittsburg.

Providence, R. I.—Bids will be received by the State Bd. Pub. Roads (John H. Edwards, Chmn.) until Sept. 6 for the construction of sections of State highways in the following towns: Cranston, 3,300 ft.; Lincoln, 5,280 ft.; Cumberland, 10,560 ft.; North Providence, 2,640 ft.; Warwick, 5,280 ft.; Middletown, 2,500 ft.; New Shoreham, 2,640 ft.; Richmond, 5,280 ft.; Warren, 4,931 ft.

Dallas, Tex.—The County Comrs. are stated to have awarded the contract for grading 4 cardinal roads from the city to the county line and West Dallas Pike to Bavouset, Larkin, Goode & Co. for $20,000.

San Antonio, Tex.—Bids are wanted Aug. 28 for the purchase of $55,000 bonds for Dist. No. 9; also same date for $75,000 bonds, to be used for macadamizing and storm water sewers for Dist. No. 8.

At present the citizens of the central part of the city are forming a district for the purpose of paving either with brick or asphalt, about 70,000 sq. yds. John D. Rullman, City Engr.

Salt Lake City, Utah.—The lowest bids recently received for paving Market St., from Main to W. Temple St., with asphalt, is stated to have been submitted by Palmer & Tate Co., of Salt Lake City, for $10,000.

**Morgantown, W. Va.*—T. Pietro is stated to have received the contract for paving with brick portions of several streets at $9,800.

**Green Bay, Wis.*—W. W. Reed, City Engr., writes that the La Crosse Stone Co., of La Crosse, has secured the contract for paving Webster Ave. and Porlier St. with 2,747 sq. yds. macadam and 14,800 lin. ft. cement curb and gutter for $30,833 (bids opened Aug. 7).

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Carbon Hill, Ala—Bids will be received until Sept. 4th by B. B. Guthrie, Town Clk., for a water and light plant, work to include furnishing approximately 365 tons of 4, 6 and 8-in. c. i. pipe, 12,500 lbs. special castings, 37 double nozzle fire hydrants, six 8-in., 11 6-in. and 14 4-in. gate valves, and the laying of 25,000 ft. c. i. pipe and settings valves, hydrants, etc.; erecting a brick or concrete block power house; furnishing a 100 hp., high-speed automatic engine; two 100 hp. boilers and fittings; furnishing 1 compound, 1 duplex and 1 feed pump; furnishing and erecting an 80,000-gal. steel tank and tower; constructing an 80,000-gal. surface reservoir and furnishing 60-kw., 60-cycle, single-phase, 2,300-volt alternator, together with exciter, switchboard and station instruments; pole line, transformers and 20 standard 6.6 ampere series enclosed arc lamps of latest design. Edgar B. Kay, Engr., Tuscaloosa, Ala.

Pomona, Cal.—It is reported that the farmers and orange growers in the vicinity of Pomona are organizing a company to build an electric power plant with which to furnish power for all pumping plants in the vicinity and operate a belt trolley line, connecting all the nearby towns and ranches, including Chino, Ontario, Claremont, North Pomona, Lordsburg, San Dimas and Covina.

Riverside, Cal.—It is reported that the Edison Electric Co. has secured the control of the plant of the Riverside Light & Power Co., and intends making improvements. It is stated that a new company is to be formed with John D. Miller as Pres.; J. A. Simms, Vice-Pres., and W. Percy, Secy.

San Bernardino, Cal.—The Little Creek Power Co., it is reported, has engaged F. A. Worthely, Supt. of the Riverside electric light plant, to prepare plans and specifications for its steam plant and distributing system in this city. It is reported that bids are soon to be asked.

Los Angeles, Cal.—The Council has adopted a report of the Lighting Com., it is stated, in which it is recommended that the City Clk. ask bids for municipal lighting under the following terms: 1 year contract not to exceed 2,000 lights, 3-year contract not to exceed 2,500 lights and 5-year not to exceed 3,000 lights.

Denver, Colo.—See "Water."

New Hartford, Conn.—The Northern Connecticut Power Co., of New Hartford, has been incorporated to operate in Litchfield, Hartford and Tolland Counties under certain restrictions, and is to develop water power on Farmington River.

Norwich, Conn.—The Uncas Power Co., of Norwich, has been incorporated with a capital of $1,000,000.

New Haven, Conn.—The New Milford Water Power Co., which has been under contract to supply electric power to the Connecticut Ry. & Lighting Co., is reported to have been sold to that corporation.

Sterling, Conn.—The Sterling Power Co. is reported incorporated with a capital of $500,000 and will distribute electric light and power to the towns of Sterling, Plainfield, Brooklyn and Killingly.

Washington, D. C.—Bids will be received until Sept. 5 by the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Motor; electrical supplies; arc lamps; ventilating sets; starting rheostats; machinery and rivet bar steel; pipe fittings; blacksmith's forges, etc.; also Sept. 19th, to furnish at the navy yards, Mare Island, Cal., and Puget Sound, Wash., the following: Motors; circuit breakers; electric wire; pneumatic drills; radiators; iron; steel; sand, etc. H. T. B. Harris, Paymaster Gen. U. S. N.

St. Petersburg, Fla.—The St. Petersburg Investment Co., which owns the electric light plant and street railway, contemplates moving the plant and reconstructing same with the addition of a 350-hp. boiler and two 250-hp. engines.

**Jacksonville, Fla.*—The Bd. of Bond Trus. Aug. 14, it is reported, awarded the contract for a 275-kw. illuminating-current synchronous motor and direct-current generator (bids received Aug. 4) to the Ft. Wayne Electric Wks., of Ft. Wayne, Ind., at $5,623.

It is reported that the Bd. of Bond Trus. has decided to ask bids for new machinery for the electric light works, to cost about $30,000.

La Grange, Ga.—The date of opening of bids for furnishing machinery and constructing an electric light plant has been extended from Sept. 5 to Sept. 15, as advertised in The Engineering Record.

Michigan City, Ind.—The Bd. of Control of the Indiana State Prison is reported as having estimates prepared for the remodeling of the electric light plant.

**Peru, Ind.*—S. T. Murdock, of Lafayette, writes that the contract for constructing the gas generating plant at Peru has been awarded to the Western Gas Constr. Co.

Decorah, Ia.—F. M. Hughes, City Clk., writes that the citizens on Aug. 15 voted to grant a franchise to the Decorah Electric Light Co.

**Morrison, Ia.*—The Morrison Electric Light Co., it is stated, has awarded the contract to erect a gas plant in Morrison to Frank S. Moses Co., of Trenton, N. J., at about $50,000.

Varck, Kan.—F. A. Sager, of the Arnold Co., Engineers, Marquette Bldg., Chicago, Ill., writes in regard to the power plant for the Spring River Power Co. that the electrical equipment for this plant has been purchased and consists of one of the 2,000 kw. Westinghouse units that was installed at the Louisiana Purchase Exposition, together with the necessary 6,600-33,000-volt step-up transformers, switching apparatus, steam-driven exciter set, lightning arresters, etc.; 2,400 hp. of Heine boilers have been purchased. Bids have been received and contracts will soon be let for the balance of the equipment, including condensers and the necessary pumps. This plant will be located at Varck, about ¾ of a mile from the hydro-electric plant recently installed for the Spring River Co., and will be operated in parallel with the above plant to supply additional power to the mines in the vicinity of Joplin and Webb City.

Campbellsville, Ky.—J. L. Atkinson, Pres. Campbellsville Lighting Co., writes that the construction of the proposed electric light plant will be under the supervision of B. S. Kincort, Supt., who will probably expend $5,000.

Newport, Ky.—An election is to be held Nov. 7th to vote on the proposition to issue $50,000 bonds for an electric light plant. Peter J. Krebs, City Clk.

Somerset, Ky.—W. G. Hunter, of Somerset, has received the franchise for an electric light plant (bids received Aug. 14). T. R. Griffin, Mayor.

Leominster, Mass.—The Leominister Electric Light & Power Co., it is stated, has been transferred to the Boston Heat, Light & Power Co., and extensive alterations and improvements are to be made.

**Holyoke, Mass.*—The Holyoke Water Power Co. is stated to have awarded contracts as follows: for a 2-story power station, 60 x 160 ft., to Casper Ranger, of Holyoke; for brick chimney, 175 ft. high, with 7-ft. flue, to Dennis Landers, and water wheels to W. & J. Jolly, of Holyoke. The contract for steam boilers has not yet been let.

Hart, Mich.—J. N. Cotton, of Hart, Pres. Pere Marquette Light & Power Co., writes that Harry McDaugh of Dayton, O., has prepared plans and specifications for improvements to this plant, which will probably be made some time within a year; probable cost of proposed work, $75,000.

**Detroit, Mich.*—The Westinghouse Machine Co., of East Pittsburg, Pa., it is stated, has received the contract for a 2,000-kw. turbine generator, together with all necessary equipment, to be installed in the lighting plant, at a cost of $61,283. The engine is to be of the Parsons type.

Grand Rapids, Mich.—The Grand Rapids Electric Light Co. is reported incorporated with a capital of $15,000. Incorporators: Walter C. Winchester, W. C. Miller and E. A. Stowe.

Wausau, Mo.—It is reported that the proposition to issue $6,000 electric light bonds carried at the recent election.

Helena, Mont.—Samuel T. Hauser, of Helena, formerly governor of Montana, writes that it is proposed to construct a dam over Missouri River, to furnish Helena and Anaconda with electricity, and bids will be received at once.

Goldfield, Nev.—It is reported that the Bishop-Nevada Electric Power & Lighting Co. has been incorporated with a capital of $1,000,000, for the purpose of constructing an electric plant on the Owens River, near the town of Bishop, to transmit power to Tonopah, Goldfield, and Bullfrog. D. Jones, of the J. Jones Exploration Co., may be able to give further information.

Atlantic City, N. J.—An ordinance has passed first reading in the City Council granting a franchise to the Atlantic City & Suburban Electric Co.

Jarilla, N. M.—R. G. Mullen, it is stated, represents a company which proposes erecting power plants along the Sacramento River for power purposes at a mining camp at Jarilla.

New York, N. Y.—Bids will be received until Aug. 31 by Wm. McAdoo, Police Comr., for furnishing electrical conductors and placing electrical conductors underground.

Brooklyn, N. Y.—The Brooklyn Borough Gas Co. is stated to have applied to the State Lighting Com. for permission to issue $1,000,000 bonds, half of which will be reserved to retire the $500,000 first mortgage bonds of the company at present outstanding. There are to be issued in the near future $100,000 bonds for improvements, including the laying of additional pipes and the construction of a new gas holder. The balance of the bonds will be retained in the treasury to be employed for future extensions and improvements.

**Little Falls, N. Y.*—The P. B. McCaghey Co. has been organized by W. J. Berrigan, of Little Falls, and J. E. McCaghey, of Sandy Hill, and others. The company has secured contracts from the Paul Smith's Hotel Co. to construct 2 electrical power plants, one at Union Falls, Clinton County, and the other at Franklin Falls, Franklin County.

Rochester, N. Y.—The Niagara Falls Electrical Transmission Co., of Niagara Falls, N. Y., is stated to have applied to Mayor Cutler for permission to erect poles and wires and to construct conduits in the streets, alleys and public places of the city and to transmit and sell electric power and light.

**Camden, N. Y.*—Jas. A. Raymond, of Camden, is stated to have secured the contract for constructing a power house for the municipal electric light plant. The structure is to be completed so that machinery can be installed by Oct. 1.

Hilton, N. Y.—A. B. Fraser, Edson Taber and John E. Cooper, of Hilton, have secured from the Village Bd. a 50-year franchise to build, equip and maintain an acetylene gas plant and to lay pipes through any or all the streets of the village. The Village Bd. has been made an offer by the company to furnish 40 lights to the village at $10 per light per year for a period of 5 years.

Albuquerque, N. M.—The Union Gas & Traction Co., it is stated, has been incorporated with a capital of $500,000, for the purpose of constructing and operating gas, oil, electric and water works plants and systems to operate a system of pipe lines, wires, etc., for the transportation of gas, oil, electricity and water, to own and develop clay, sand, cement and other lands and properties, to operate steam, electric and cable street cars or traction lines. Incorporators: C. H. Pattison, Kansas City, Mo.; W. L. Pattison, Gardner, Kan.; J. F. Luthy,

**Items marked thus give the names of parties awarded contracts.*

Albuquerque, N. M., and others. The principal place of business is to be Albuquerque, N. M.

Fayetteville, N. C.—It is proposed to expend about $20,000 on the municipal electric light plant and line extension, the work to include the installation of 2 boilers, 300 hp., one or two engines; one 250-kw. alternator and two 120-kw. generators. W. T. Jones, Supt.

Toledo, O.—Chas. S. Ashley, Pres. of the Central Heating & Lighting Co., it is stated, has announced that extensive improvements are to be made in the company's lighting plant, which is located in the Meredith Bldg.

At the fall election the citizens will be asked to vote on the installation of a municipal electric light plant. F. I. Consaul, Ch. Engr. Bd. of Pub. Service, has prepared an approximate estimate of the cost of such a plant, which it is reported will cost about $470,000.

At a meeting of the stockholders of the Toledo Gas Light & Coke Co., on Aug. 17, the merger between that company, the Toledo Htg. & Lighting Co. and the Citizens' Htg. & Lighting Co. was practically completed. About $1,000,000 will, it is stated, be expended in extensions, new machinery and other improvements. Willard F. Robison, Pres.; Edgar C. Hampton, Secy.

Reading, O.—Geo. Hornung, Consulting Engr., 612 Johnston Bldg., Cincinnati, writes that bids will be received Oct. 15 for the construction of a new electric light plant for Reading, to cost about $30,000.

Drain, Ore.—The Skelley Lumber Co., it is stated, is about to apply to the Town Council for a water and light franchise.

Philadelphia, Pa.—John C. Sager, Chief of the Electric Bureau, writes that the Philadelphia Electric Co. bid on Aug. 15 for furnishing electric arc lights for the year 1906, $99.42 per light per yr. (average); total cost, $1,073,272.

Middleburg, Pa.—Bids will be received until Sept. 1 by Geo. W. Wagenseller, Secy. Middlecreek Electric Co., at Middleburg, for constructing a complete water power electric plant, 100 hp., on Middlecreek and Penns Creek, two miles south of Selinsgrove. Bids will be received on the work as a whole and also on portions of the work, as follows: Solid concrete dam, 17 to 20 ft. high and about 360 ft. long; to dig a tunnel and waterway 1,225 ft. through a mountain; a power house; 2 units with 4 wheels-direct connected generators; auxiliary engine and boiler and complete equipment, with 25 or 30 miles line construction, to furnish light, heat and power to Selinsgrove, Sunbury and Northumberland. Geo. W. Wagenseller, Secy.; F. W. Darlington, Real Estate Trust Bldg., Philadelphia, Pa., is the designing engineer.

St. Louis, Mo.—All bids received Aug. 15 for furnishing the electricity for lighting the buildings in Dist. No. 1 have been rejected and new bids are to be received Aug. 30. W. B. Dryden, Secy. Bd. Pub. Improv.

Bristol, Tenn.—The directors of the Bristol Gas & Electric Co., of New York, N. Y., are reported to have purchased an interest in the company here. The company owns all the gas, electric and street railways in Bristol, Tenn., and Bristol, Va., and it is stated that about $1,000,000 will be expended in improving the power plant, installing steam turbines process, and extending the street railways in all parts of the city.

Oliver Springs, Tenn.—Fred C. Sinckneicht is reported to have decided to construct an electric light plant at this place, and is in the market for an engine.

Vernal, Utah.—The City Council is stated to have passed an ordinance granting Geo. H. Seth a franchise for an electric light, heating and power plant.

Salt Lake City, Utah.—J. H. Bigger and J. E. Hill, of Salt Lake City, are stated to have filed in the office of Caleb Tanner, State Engr., application for permission to take water from American Fork Creek. They propose developing 950 hp. for electric lighting and for propelling machinery in the American Fork mining district. The proposed diverting works are to consist of a dam, spillway, headgate and pipe line.

Burlington, Vt.—The following are the three lowest bids received and opened on Aug. 22 by the Superv. Archt., Treas. Dept., Washington, D. C., for installing a conduit and electric wiring system for the U. S. Postoffice and Custom House, at Burlington. W. W. Gale, New Haven, Conn., $1,994; Plummer Electric Co., Boston, Mass., $1,813, and John Wilkinson Co., Boston, Mass., $2,147.

Everett, Wash.—The Mayor, it is reported, has been directed by the City Council to appoint a committee to investigate the possibility of establishing a municipal electric light plant. The committee is to report by Sept. 1.

Charleston, W. Va.—See "Electric Railways."

Little Chute, Wis.—It is reported that the Kaukauna Electric Light Co. (W. H. Nelson, of Milwaukee, Secy.) has applied for an electric light franchise here.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Tuscaloosa, Ala.—The construction of an interurban railroad between Tuscaloosa and Birmingham is reported under consideration. J. A. Montgomery, J. M. Dewberry, A. C. Howze and Geo. E. Harrison are reported interested

Pomona, Cal.—See "Power Plants, Gas and Electricity."

San Francisco, Cal.—It is stated that the Ocean Shore Ry. Co. (A. D. Bowen, Mgr.) will open bids Sept. 1 for the construction of its standard-gauge electric road, 82 miles in length, connecting San Francisco and Santa Cruz. It has been decided to double track the line for the entire distance. Redwood ties and some of the rails are being received, and additional materials have been ordered.

San Bernardino, Cal.—Seth Hartley, who successfully promoted the San Bernardino Valley Traction Company, is stated to have applied to the City Council of San Bernardino and the City Trustees of Colton for franchises for an electric railway covering parts of both cities, and an application has also been made before the Supervisors for a right of way for electric railway connections with Uplands, Hermosa, Etiwanda, Cucamonga and Rialto, with the Salt Lake terminus in this city. The franchises are for a double-track system to Uplands.

St. Augustine, Fla.—The City Council has passed an ordinance granting a franchise to the Jacksonville, Suburban & Seashore Ry. to enter St. Augustine.

Yaycross, Ga.—A. Sessoms, C. M. Sweat, J. M. Bell, John T. Myers and others are stated to have made application to the City Council for a franchise to operate an electric railway in Waycross to be known as the Waycross St. & Suburban Ry. Co.

East St. Louis, Ill.—The Ozark Mountain Electric Ry. Co. will on Aug. 28 petition the City Council of East St. Louis for a franchise to construct, operate and maintain an electric railway on Market Ave., 27th and 4th Sts. It is its intention to construct an electric railway from this city to Belleville, and the right of way is said to have been secured. E. W. Hartman, Pres., East St. Louis.

Ft. Wayne, Ind.—The Ft. Wayne & South Bend Traction Co. has just completed their survey from South Bend to Ft. Wayne and expect to have a large force grading on the South Bend end of the line in thirty days.

Mishawaka, Ind.—The Common Council is stated to have granted a franchise to the Indianapolis, Logansport & South Bend Traction Co.

Claremore, Ind. Ter.—A charter for an electric railway is stated to have been granted to T. S. Chambers, of Blackwell, Okla. Ter. The proposed electric railway will connect the business and residential portions of Claremore with the radium springs, and extend to the lakes, 6 miles south of Claremore.

Paul's Valley, Ind. Ter.—At a mass meeting at the Court House recently, the proposition of the Oklahoma City & Sulphur Electric R. R. to build a line through here between Oklahoma and Sulphur, passing through Wynnewood, was considered reasonable, and $9,000 of the bonus was raised.

Baltimore, Md.—The Town Council of Takoma Park is stated to have adopted an ordinance granting the right of way to the Baltimore & Washington Transit Co. to construct and operate a single-track railway.

Escanaba, Mich.—The Menominee & Escanaba Ry. Co. is reported incorporated with a capital of $300,000, to build a line between Menominee and Escanaba.

Niles, Mich.—Harris F. Holland, Pres. of the Holland Palace Car Co., of Indianapolis, is reported to be at the head of the movement contemplating the building of another interurban electric line from Niles to Kalamazoo by way of Cassopolis and Diamond Lake. The line will be about 50 miles long.

**Kansas City, Mo.*—Jacques A. Haskins, of Kansas City, has been awarded the contract for constructing the Kansas City-Olathe Electric Ry.

Albuquerque, N. M.—See "Power Plants, Gas and Electricity."

Ilion N. Y.—Two surveys have been made for the proposed electric railway from Ilion to Sidney, one by way of East Winfield, and the other by Chepachet More than half the right of way through Herkimer County has been obtained. A franchise is to be asked for in Ilion soon. The length of the road will be 60 miles. Judge McKeon, of Ilion, and S. L. Kelsey, of Burlington Flats, are reported interested.

Toledo, O.—The Toledo Southern Ry. (D. H. James, Pres.) has been incorporated with temporary capital of $10,000. It is proposed to build a line from Fostoria to Marion, closing up the only gap between Toledo and Columbus.

Steubenville, O.—The Steubenville, Mingoe & Ohio Valley Traction Co.'s franchises and property is stated to have been absorbed by the Steubenville & Wheeling Traction Co. A. M. Snyder, of Cleveland, Pres., and A. A. McCaslin, of Cleveland, Secy. The company will extend the line south to the Jefferson County line to connect with a line to Wheeling, and north to Empire, the intention being to connect with the United Power Co., of East Liverpool.

Canton, O.—The Canton & Youngstown Ry. Co. is stated to have announced that practically all the right of way for the proposed line has been secured. J. E. Monnett, Pres.

Elyria, O.—The Cleveland & Southwestern Traction Co. is reported to be planning to build a spur line from North Amherst to Vermillion.

Lima, O.—The Lima & Eastern Ry. Co. is reported incorporated with a capital of $100,000, by F. O. Olson, C. H. Chappell, A. A. Shafer, and others. It is proposed to build an electric railway from Lima to Marion by way of Kenton, and it is announced that it is the intention to equip the road with gasoline motors.

Youngstown. O.—It is stated that Harry G. Hamilton and associates are planning to build a line from Youngstown to Yellow Creek and Poland.

Shawnee, Okla. Ter.—The City Council is stated to have granted Willis E. Fertig and associates a franchise to build and operate a street railway in this city. It is understood that Mr. Fertig is to purchase the Shawnee Traction Co., which is now in the hands of a receiver.

York, Pa.—It is reported that a survey will be made for an electric railway from Red Lion to York Furnace, Brogueville and Airville, a distance of more than 15 miles. The line is the project of an independent company, and contemplates furnishing the connecting link for through electric service to Baltimore. A line is being surveyed from Baltimore to Belair, Md., and a survey is under way for another line from Belair to Delta, work on which will be begun before very long. With the line contemplated to Yonkers, there will remain only the distance from Delta to the terminus of this line to be spanned, and the line through to Baltimore will be complete. S. M. Manifold is reported to have charge of the survey for the line.

Scranton, Pa.—A charter is stated to have been granted to the Scranton & West Side St. Ry. Co. to build 3½ miles of electric railway, from Mifflin Ave. and Center St. to the city line. Capital, $24,000. Ezra H. Ripple, Pres.; Dirs., A. J. Connell, F. W. Ogden, Thos. Richards and W. D. Parry.

Philadelphia, Pa.—It is reported that the Philadelphia & Reading Ry. Co. is reported to have plans under way for the electrification of its suburban lines out of the city.

Bristol, Tenn.—See "Power Plants, Gas and Electricity."

Ft. Worth, Tex.—The Northern Texas Traction Co. is stated to have announced that this company will expend $50,000 in improvements on the interurban and city lines. The former are to be rock ballasted from Ft. Worth to Oak Cliff, while the lines in this city are to be extended and otherwise put in better condition. The Hemphill line will be extended to a point about 1 mile from its present terminal.

Everett, Wash.—The City Council is stated to have passed the electric franchise asked for by the Rapid Ry. Co.

Seattle, Wash.—It is stated that the Seattle Electric Co. will file application for franchises for the construction of new and the extension of two of its old lines, calling for a total expenditure of approximately $150,000.

Morgantown, W. Va.—The Sabraton Ry. Co. is reported to have been granted a franchise for the construction of an electric railway here.

**Charleston, W. Va.*—The contract for the construction of the dam and raceway of the hydro-electric plant for the Winchester & Washington City Ry. has been awarded to Edw. Purcell & Co., of Harrisonburg, Va., at a total of about $56,233. N. Wilson Davis, Con Engr., Charleston,

Toronto, Ont.—It is stated that the Toronto & York Radial Ry. Co. will extend the Toronto & Mimico branch to the western boundary of Etobicoke Township. An overhead bridge will be built over the Etobicoke River.

Vancouver, B. C.—It is stated that the British Columbia Electric Ry. Co. will commence work immediately on the construction of 5 miles of new lines to North Vancouver.

Monterey, Mex.—See "Water."

RAILROADS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The Pine Bluff North & South R. R. Co. is reported to have decided to build its road north of this city to a connection with the Rock Island R. R., probably at DuVall's.

Ocilla, Ga.—The Broxton, Hazlehurst & Savannah R. R. Co. is reported to have made application for charter for a railroad, 28 miles long, to be constructed from Osierfield, through Coffee, Appling, Tattnall, Liberty, Bryan and Chatham Counties. The towns to be reached by this line are Ocilla, Douglas, Hazelhurst, Glennville, Hinesville, Clyde and Savannah. Incorporators: J. A. J. Henderson, W. N. Smith, J. A. Pruitt and others, all of Ocilla.

Golconda, Ill.—The Shawneetown & Western R. R. Co., with principal offices at Golconda, and a capital of $50,000, is reported incorporated. The road is to be constructed from Shawneetown to a point on Ohio River in Massac County. Incorporators: John Gilbert, H. B. Pierce and J. Moore, of Golconda, and others.

Indianapolis, Ind.—The officials of the Vandalia Ry. Co. (Thos. Rodd, Ch. Engr., Pittsburg, Pa.) and the City Engrs. Dept. are reported to have under consideration the elevation of tracks; the proposed cost of work is from $320,000 to $400,000.

**Caney, Ind. Ter.*—W. R. Stubbs, Monadnock Bldg., Chicago, Ill., is stated to have secured the contract for building the Caney, Oklahoma & Texas R. R., Senator Porter's projected railroad, which will run from Caney to Perry, a distance of 116 miles.

Des Moines, Ia.—It is stated that the Iowa Central R. R. and the Minneapolis & St. Louis R. R. (Howard G. Kelley, of Minneapolis, Minn., Ch. Engr. for both roads) will be connected in Des Moines via the Iowa Central branch from New Sharon to Newton. The M. & St. L. R. R. Co. is reported to have decided on improvements, including the construction of 3 heavy steel or concrete bridges northwest of Valley Junction, contracts for which are to be let at once.

Torrent, Ky.—J. T. and Floyd Day are stated to have decided to build a narrow-gauge railway from Torrent County to Campton. The road will be about 12 miles in length and connect with the Louisville & Nashville at Torrent.

Providence, Ky.—Bids will be received by the Missouri Constr. Co., at Providence, Ky., or Cape Girardeau, Mo., for 26 miles of team work on the Morganfield & Atlantic Ry., between Morganfield and Providence, Ky.

Riverside, Md.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore) is reported to have decided to make extensive improvements at Riverside, near the Locust Point yards. A coal trestle 900 ft. long is to be erected with coal pockets; also sandhouse and ash pits.

Taunton, Mass.—A preliminary plan is reported to have been agreed upon by the Asst. Engr. of the N. Y., N. H. & H. R. R. and City Engr. A. Crowell, representing the special grade crossing commission appointed by the Mayor, for the elimination of the grade crossings on the railroad; it is proposed to erect a new granite passenger station on Tremont St.

Benton Harbor, Mich.—The West Michigan Ry. Co. is reported incorporated, with a capital of $700,000, to construct 85 miles of road from Benton Harbor to Kalamazoo via Cassopolis and Paw Paw.

**Morehead City, N. C.*—The McLean Contr. Co., of Baltimore, Md., is stated to have secured the contract for the construction of 2 miles of trestle work between Morehead City and Beaufort on the Atlantic & North Carolina R. R. The work includes the construction of 2 drawbridges.

Philadelphia, Pa.—The Finance Com. of City Council on Aug. 17 recommended a permanent loan of $4,000,000 with which to abolish the 9th St. grade crossings and those on the Port Richmond branch of the Philadelphia & Reading Ry.

**Pittsburg, Pa.*—Press reports state a contract has been awarded to Wm. Kenefick & Co., of Pittsburg, for the construction of a part of the Western Pacific R. R., to be built by Geo. J. Gould. The contract price is reported to be about $15,000,000.

Pittsburg, Pa.—The Pittsburg & Cross Creek R. R. Co. has been incorporated with a capital of $70,000, to construct a line about 7 miles in length in Washington County, from Pryor Station along the north branch of Cross Creek to Burgettstown. Incorporators: N. T. Sanford and J. W. Patterson, of Pittsburg; B. U. Young and S. A. Wortman, of New Castle, and others.

**Items marked thus give the names of parties awarded contracts.*

Wilkinsburg, Pa.—Plans are reported to be on foot between the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) and the Borough Council to raise the R. R. tracks about 6 ft. and lower streets doing away with the grade crossings; cost of proposed work including steel girder overhead bridges is about $250,000.

Tacoma, Wash.—The Tacoma & Eastern R. R. Co. (Henry Shaw, Ch. Engr., Tacoma) is stated to have filed a certificate with the Secretary of State of its intention to construct two extensions in Pierce and Lewis Counties, one from Park Junction, 7 miles, via Kapowsin, Eatonville and Elba, the other branch from a point about 5 miles beyond Park Junction and extend 2¾ miles to a point in section 12, township 14, range 4 east.

Vancouver, Wash.—The Wallula Pacific R. R. Co. is reported incorporated, with a capital of $1,000,000, to build, operate or acquire a railroad and telegraph line from Wallula on bank of Columbia River, across the river at a point near Wallula and along the river to a point in Washington on Columbia River; also to consolidate with other companies or transportation lines, or maintain traffic relations with them, to acquire, operate and maintain steamboat lines on the Columbia, Willamette and Snake Rivers in Wash., Ore., and Idaho. L. Gerlinger, of Portland, Ore., and J. P. Stapleton, of Vancouver, Wash., are among the incorporators.

Fayette, W. Va.—The Fayette & Fayetteville R. R. Co. is reported to have secured the necessary franchises for the building of the new line in Fayette and Fayetteville.

Ashland, Wis.—The Ashland, Odanah & Marengo Ry. Co. has been incorporated, with a capital stock of $100,000, to operate a line from Odanah to Sedgwick, on the line of the Duluth, South Shore & Atlantic Ry. Directors: L. K. Baker and Geo. F. Merrill, Ashland; E. B. Hill, of Odanah; J. S. Stearns, of Ludington, Mich., and others.

Appleton, Wis.—O'Keefe & Orbison are about to start surveying for a new railway to be constructed from Green Bay to Neenah by the Valley Ry. Co., just incorporated by Thos. W. Orbison, John Hackworthy, Edw. O'Keefe and others, all of Appleton.

Guaymas, Mex.—A contract is reported to have been signed between the Government and J. A. Naule in behalf of the Southern Pacific R. R. (Wm. Hood, Ch. Engr., San Francisco, Cal.) whereby the latter will construct a railroad from Guaymas to Guadalajara, or some other point on the Mexican Central line. The road will cost about $30,000,000 to construct.

Brandon, Man.—The Great Northern R. R. Co. (Jas. J. Hill, Pres. St. Paul, Minn.) is reported to have decided to extend one of the branch lines from St. John, N. D., into Brandon, a distance of about 75 miles.

Winnipeg, Man.—Press reports state that the National Constr. Co. has been formed, and has entered into a contract with the Grand Trunk Pacific Ry. Co. (J. Hobson, Ch. Engr.) to construct the line from Winnipeg to the Pacific Ocean, and also a branch line from Ft. William to Lake Superior Junction.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

New Haven, Conn.—It is stated that bids will be received until Aug. 31 by the Bd. Fire Comrs. (S. J. Metzger, Secy.) for erecting a fire engine house on Dixon Ave., requiring masonry, carpentry work, plumbing and heating. Brown & Von Beren, Archts., 865 Chapel St.

**Chicago, Ill.*—Jas. McMahon & Co., 1030 N. Waller Ave., it is stated, have secured the contract to remove the old court house building at about $100,000.

Jas. Gamble Rogers, Ashland Blk., is preparing plans for alterations in the Presbyterian Hospital at Wood and Congress Sts. The improvement will cost about $100,000.

Indianapolis, Ind.—The Comn., it is reported, has accepted plans for 22 buildings, which are to be erected at the deaf and dumb institute, north of Indianapolis. Estimated cost of improvements, $280,000.

Hartford City, Ind.—Rev. Chas. Dhe, pastor of St. John's R. C. Church, it is reported, is contemplating the erection of a hospital at a cost of $50,000.

Des Moines, Ia.—It is reported that the Bldg. Com. of the City Council is considering the erection of a new city hall at a cost of $400,000.

Burlington, Ia.—The following are the bids opened on Aug. 17 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction complete of extension to U. S. Post-Office at Burlington: Morse Constr. Co., Topeka, Kan., $47,875, and Bartlett & Kling, Cedar Rapids, $36,460.

Independence, Kan.—It is reported that the issue of $75,000 bonds has been authorized toward the erection of a Carnegie Library.

Louisville, Ky.—The erection of a new police building at a cost of about $100,000, is reported under consideration.

Portland, Me.—Bids will be received Sept. 4 by the Bd. Co. Comrs. (Geo. F. Plaisted, Chmn.) for the excavation and construction of the foundation for the new court house here. Geo. Burnside, Archt., 120 Exchange St.

Watertown, Mass.—A. F. Haynes, of Boston, has prepared plans for a fire and police station which is to be erected at Main and Cross Sts. at a cost of $23,000.

**Red Wing, Minn.*—J. & W. A. Elliott, of Minneapolis, it is stated, have received the contract to erect the superstructure of the City Hall and Central Fire station at $20,600.

Duluth, Minn.—Bids will be received until Sept. 18 by Maj. Chas. L. Potter, Corps. Engrs., U. S. A., Duluth, for erecting a U. S. Engineer Bldg., at Duluth, as advertised in The Engineering Record.

Aberdeen, Miss.—It is stated that bids will be received until Sept. 4 by C. P. Smith, Co. Clk., for installing a steam heating system in the Co. Jail; system to include radiators, Mercer sectional boiler, steam piping, fittings, etc. And. J. Bryan, Archt., 708 Hennen Bldg., New Orleans, La.

Rosedale, Miss.—Bids will be received until Oct. 2 by the Bd. Superv., at Rosedale, for furnishing materials and repairing present court house; Spencer & Temple, Archts., Champaign, Ill.

Cleveland, Miss.—Bids will be received by the Bd. Superv. at Cleveland until Oct. 2 for installing a hot-air heating apparatus in jail at Cleveland.

Gulfport, Miss.—The City Council on Aug. 12 accepted plans for the new City Hall, which it is proposed erecting at a cost of $20,000.

**Kansas City, Mo.*—Chas. C. Smith, of Kansas City, Mo., has secured the contract for the cut stone, brick work, steel concrete, metal work, roofing, etc., in connection with the erection of the General City Hospital (bids received Aug. 15) at $149,994. Fredk. C. Gunn, Archt., 208 Grand Ave.

**Higginsville, Mo.*—The Bd. of Trus. of the Confederate Home, it is stated, has awarded the contract to erect a hospital at the home (bids opened Aug. 1) to Henry Meyers of Mexico, Mo., at $18,000, exclusive of heating, plumbing and lighting.

Portsmouth, N. H.—The following are the bids opened on Aug. 19 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for naval prison extension, Navy Yard, Portsmouth (the bids submitted also contain certain deductions and modifications): *a* for administration building, including conduit and wiring installation, but not elevator, plumbing, heating, excavation or grading; *b* excavation and grading; *c* elevator; *d* heating system complete; *e* plumbing administration building; *f* for completion of additional cells; *g* plumbing prisoners' wing only; *h* for all plumbing complete; *i* for complete work with modification by contractor: Otis Elevator Co., New York, N. Y., *c* $4,900. Wm. N. Tobin, 407 S. Clinton St., Syracuse, N. Y., *d* $3,315, add $268 conditionally; *e* $3,117; *g* $17,226. The Snare & Triest Co., New York, N. Y., *a* $125,500; *b* $4,500; *f* $45,000; *i* $125,500. John P. Sweetser, 46 Market St., Portsmouth, N. H., *e* (2 bids) $2,900 and $2,800; *g* $13,447; *h* (2 bids) $16,227 and $15,327. Burnham & Stevens, 116 Dartmouth St., Boston, Mass., *e* $2,844; *g* $12,099; *h* $14,794. Huey Bros., 35 Hartford St., Boston, Mass., *d* $2,737; *e* $2,087; *g* $12,222; *h* $14,309. Penn Bridge Co., Washington, D. C., *a* $130,500; *b* $4,950; *f* $47,800. Thompson & Spear, 30 Oliver St., Boston, Mass., *e* $4,277; *g* $13,500; *h* $17,777. The Marine Engine & Machine Co., New York, N. Y., *c* $4,708. Jas. Wilkinson & Co., 51 Franklin St., Boston, Mass., $2,542 conduits Administration Bldg.; $1,389 same prisoners' wing; $123 same in elevator. General Fire Extinguisher Co., 170 Westminster St., Providence, R. I., *d* $3,900. Mesker & Bro., 421 S. 6th St., St. Louis, Mo., *f* $49,975. Walworth Constr. & Supply Co., 100 Pearl St., Boston, Mass., *d* $3,288.

Ft. Mott, N. J.—Bids will be received until Aug. 28 by Capt. Louis F. Garrard, Jr., Q. M., U. S. A., Delaware City, Del., for constructing an oil house at Ft. Mott.

**New York, N. Y.*—W. N. Tobin, of Syracuse, it is reported, has received the contract for the ventilating and heating of the two hospital bldgs. on North Brothers' Island, and also for the fitting of a power plant on the Island at about $10,000.

W. N. Tobin, of Syracuse, submitted the lowest bid on Aug. 10 for ventilating and heating the Aquarium at $15,298.

Bids wil be received until Sept. 5 by Thos. W. Churchill, Deputy and Acting Fire Comr., for furnishing materials and erecting a brass foundry and storage yard at 56th St. and 12th Ave., Boro. Monhattan.

Bids will be received until Aug. 31 by Wm. McAdoo, Police Comr., for furnishing materials and making general repairs and improvements to heating system at several precinct police stations and other department buildings for the Police Dept., City of New York.

Plans have been filed for a municipal lodging house which is to be erected by the City of New York at 1st Ave. and 25th St. It is to be a 6-story fireproof structure of brick and limestone and cost $150,000. Raymond F. Almirall, Archt., 51 Chambers St.

*Behan & Cavanaugh, 44 E. 23d St., have received the contract to erect a male dormitory at Blackwell's Island (bids opened Aug. 18) at $47,249. The contract for plumbing same, bids received at the same time, has been awarded to Albert Winternitz, 237 E. 72d St., at $4,300.

Ft. Wood, N. Y. H., N. Y.—Capt. Traber Norman, Constructing Q. M., U. S. A., Governor's Island, writes, that all bids opened on Aug. 7 for erecting a hospital at Ft. Wood, have again been rejected. No date yet set for the receiving of new bids.

**Saratoga, N. Y.*—The Hudson Valley Constr. Co., of Troy, has secured the contract to make additions and alterations in the State Armory at Saratoga Springs, at $31,440.

**Binghamton, N. Y.*—It is reported that the State Comn. in Lunacy at Albany has awarded the contract to erect a building for 500 chronic patients at the Binghamton State Hospital, to Matthew Stipp, of Scranton, Pa., for $145,072. R. T. Ford, of Rochester, has the contract for the heating of same at $13,665 and for the plumbing at $17,900. The contract for the electric wiring and fixtures, it is stated, has been awarded to the G. & E. Electrical Constr. Co., of Binghamton, at $4,550.

Ft. Ontario, N. Y.—Bids will be received until Aug. 31, by Capt. W. M. Coulling, Q. M., U. S. A., Oswego, N. Y., for furnishing materials and constructing a brick quartermaster's workshop.

Ft. Totten, N. Y.—Bids will be received until Sept. 15 by Capt. Geo. H. McManus, Constr. Q. M., Ft. Totten, for storm vestibules and storm sash to be installed on 14 buildings at this post, as advertised in The Engineering Record.

Sonyea, N. Y.—It is stated that bids will be received until Sept. 5 by Geo. L. Williams, Pres. Bd. Mgrs., Craig Colony for Epileptics, Sonyea, for constructing, heating, plumbing, electric light wiring and fixtures for 6 dormitories. G. L. Heins. State Archt., Albany.

Fremont, O.—S. H. Shively, of Fremont, has prepared plans for the hospital which is to be erected at the Infirmary.

Gallipolis, O.—The Emergency Bd. at Columbus has authorized $17,500 for remodeling the heating plant at the Gallipolis State Hospital and $2,000 to increase the water supply at the State School for the Deaf and Dumb.

Cleveland, O.—Bids will be received until Sept. 16 by the Bd. Trus., Cleveland State Hospital (Adams B. Howard, M. D., Secy.) for furnishing materials to erect and equip a cold-storage plant; Frank L. Packard, Archt., Columbus.

*The Celevland Steam Fitting & Supply Co., 1084 Hamilton St., has been awarded the contract for the heating system for the new public bath house, which is being erected on Broadway and Canton Sts., at $2,093.

**McKeesport, Pa.*—Wm. Weber, of Huntington, W. Va., has secured the contract for constructing the U. S. Post-Office at McKeesport (bids opened Aug. 16) for $63,000.

Philadelphia, Pa.—Henderson & Co., 1221 Arch St., it is stated, submitted the lowest bid for repairing the fire house occupied by Truck No. 6, at $9,986.

Erie, Pa.—Bids will be received until Sept. 18 by Louis Wagner, Chmn., Soldiers' and Sailors' Home, at the 3rd Natl. Bank, Philadelphia, for erecting a 2-story brick laundry building at said home in Erie.

Monks Corner, S. C.—Bids will be received until Sept. 4 by the Bd. Co. Comrs. for erecting a brick jail with steel cells. Jesse H. Harvey, Co. Superv.

Memphis, Tenn.—Meyer J. Sturm, Archt., 84 La Salle St., Chicago, Ill., writes that bids will be received about Oct. 1 for the erection of a woman's hospital at Memphis.

**Sherman, Tex.*—F. L. Stevenson Contract Co. of Dallas, has secured the contract for erecting the U. S. Post-Office and Custom House at Sherman, for $111,390.

Salt Lake City, Utah.—It is reported that bids will be received until Sept. 2 by the Bd. Co. Comrs. for plumbing, steam fitting and electric wiring in the main building of the County Infirmary.

North Yakima, Wash.—Press reports state that bids will be received until Sept. 4 by the Bd. Co. Comrs. for constructing a fireproof court house; probable cost, $80,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—The farmers of Madison County, it is reported, are forming a company and intend erecting a cotton warehouse to cost about $25,000.

Livingston, Ala.—The Livingston Improv. Co., it is reported, intends erecting a hotel here to cost $25,000. Maj. T. B. Smith is reported interested.

Little Rock, Ark.—The Interstate Amusement Co., it is reported, intend erecting a theatre on Main and 8th Sts., to cost $30,000.

Oakland, Cal.—The La Parra Grand Hotel Spring Co. has been incorporated with a capital of $500,000, and plans to erect a hotel for the Montecito Valley. The plans include an electric power and lighting plant.

Los Angeles, Cal.—A. F. Rosenheim, Hellman Bldg., has completed plans for a theater and office building, to be erected on east side of Bway., bet. 6th and 7th Sts.

**Savannah, Ga.*—J. P. Pettijohn & Co., of Lynchburg, Va., it is reported, have secured the contract to erect 2 warehouses, 490 x 140 ft., for the Seaboard Air Line Co., on Slip 3.

**Springfield, Ill.*—V. Jobst & Sons, of Peoria, it is stated, has secured the contract to erect a 4-story office building for the Central Telephone Co., at 422 S. 5th St., to cost $50,000.

Chicago, Ill.—The German Hodcarriers' Union & Benevolent Society, it is stated, intends erecting a 3-story building at a cost of $50,000, to be used as a store and lodge halls.

Geo. W. Stewart, the builder, has had plans prepared by Jas. Gamble Rogers, Ashland Blk., for a family apartment hotel, to be erected at Sheridan Road and Buena Ave. The building will be 3 stories high, and cost $150,000.

Jenney, Mundie & Jensen, 171 La Salle St., are preparing plans for remodeling the building recently bought by Dr. L. B. Baldwin, at Michigan Boule. and 12th St., into a hospital and hotel for invalids. A new structure, containing dormitory for nurses, operating rooms, and other appointments will be added. The entire work will cost $150,000.

The department store of F. H. Knoop, at North Ave. and Vine St., is to be enlarged by an annex of 3 stories, 52 x 100 ft. Cost $40,000.

The Northwestern Terra Cotta Co. will build a 2-story office building at 641 Dunning St. at a cost of $25,000.

Tentative plans, subject to the approval of officials of the Pullman Co., it is stated, have been prepared for an 18-story steel building, costing between $2,500,000 and $3,000,000, on the site now occupied by the Pullman Building.

An 18-story building is to be erected for the Illinois Life Insurance Co. at La Salle and Monroe Sts. Holabird & Roche, 1618 Monadnock Bldg., are the Archts. Probable cost $2,000,000.

Holabird & Roche, 1618 Monadnock Bldg., are receiving proposals for the erection of the 16-story annex to the Marquette Bldg., which is to cost about $600,000.

Judge Lambert Tree has decided to erect a store, hall and office building at W. Madison St. and 40th Ave., for which Hill & Woltersdorf, 70 La Salle St., have prepared the plans. This building will be 3 stories high, 100 x 76 ft., pressed brick, terra cotta, and plate glass, and cost $60,000.

Indianapolis, Ind.—The Trus. of the Herron Art Inst., it is reported, will soon ask bids for erecting a brick and stone building, estimated to cost $80,000.

Hartford City, Ind.—It is stated that the Masons intend erecting a temple and have had $15,000 donated toward the project.

Wynnewood, Ind. Ter.—Many of the prominent citizens are said to be interested in the proposition to erect a hotel, opera house and city hall, to cost $20,000.

Davenport, Ia.—The Chicago, Burlington & Quincy (W. L. Breckinridge, Engr., Chicago, Ill.) and the Chicago, Milwaukee & St. Paul Railroads (D. J. Whittemore, Ch. Engr., Chicago, Ill.), it is stated, have reached an agreement whereby $200,000 is to be spent in erecting a union depot and other improvements in Davenport.

**Sioux City, Ia.*—The Payette Constr. Co., it is reported, has secured the contract to erect the Selzer Bldg., at 312 Pierce St., at $30,000.

Louisville, Ky.——D. X. Murphy & Bro., Archts., 250 5th Ave., it is stated, has taken out a permit to erect

**Items marked thus give the names of parties awarded contracts.*

a 6-story reinforced concrete office and warehouse, 125 x 100 ft., for the Belknap Co., at a cost of $110,000.

The Western Jockey Club, it is reported, will erect a $60,000 steel grand stand at Douglas track. Address Secy.

New Orleans, La.—Toledano & Wogan, 830 Canal St., it is reported, are preparing plans for the Hotel Denechaud, which is to be erected at Perdido, Baronne and Carroll Sts., at a cost of about $450,000.

The members of the Harmony Club, it is stated, intend making improvements to the club house at Jackson and St. Charles Aves., to cost $75,000.

**Baltimore, Md.*—The Terminal Warehouse Co., it is stated, has applied for a permit to erect a 2-story warehouse, 100 x 250 ft., at Constitution and Monument Sts., at a cost of $63,000. Chas. L. Stockhausen, 208 Patterson St., Contractor; Owens & Sisco, Archts.

Frederick, Md.—Frank L. Stoner, of Frederick, and others, it is stated, have formed a company with a capital of $60,000, for the purpose of erecting a hotel here.

Templeton, Mass.—Allen & Collins, of Boston, it is stated, have prepared plans for an addition to be erected to the Templeton Inn, at a cost of $75,000. It is reported that the contract will probably be awarded by the Archts. about Sept. 15.

Taunton, Mass.—See "Railroads."

**Hampden, Mass.*—The contract to erect the Odd Fellows' Bldg., at 46 Pynchon St., it is stated, has been awarded to W. D. McKenzie at $31,192.

St. Louis, Mo.—The May Company Department Store, 6th and Washington Ave., is preparing to make extensive enlargements and improvements, occupying the remainder of the block through to Lucas Ave. The new apparatus includes among other things, 10 modern electric elevators, proposals on which will be received in the immediate future by the Consulting Engr., Wm. H. Bryan, Lincoln Trust Bldg., St. Louis.

It is reported that a 13-story annex is to be erected at the Frisco Bldg., to be leased by the St. Louis & San Francisco R. R. Co. Cost, $200,000.

A building permit has been issued to Adolph Lopez to erect a 7-story mercantile building at 618 N. 11th St., at a cost of $20,000.

Springfield, Mo.—Barnett, Haynes & Barnett, of St. Louis, Mo., it is reported, are the archts. for the Hotel Barnett, which is to be erected here by the Colonia Hotel Co. Capital, $200,000.

Newark, N. J.—Plans are being prepared for a 3-story brick building which is to be erected for the Borden's Condensed Milk Co., at 4th and Mt. Pleasant Aves., to be used as a distributing depot.

**Albuquerque, N. M.*—A. J. Morgan, it is stated, has secured the contract to erect a hotel and business building at 1st and Coal Aves., for Andres Romero, at a cost of $25,000.

New York, N. Y.—Plans have been filed by Jackson & Rosencranz, Archts., 31 Union Sq., W., for a 9-story brick hotel, 40 x 92 ft., on 47th St. and 7th Ave., for H. M. Swetland. Cost $110,000.

**Lockport, N. Y.*—John Moon, of Lockport, it is stated, has received the contract to erect the 6-story building for the Farmers' & Mechanics' Savings Bank, cost $25,000.

Rochester, N. Y.—A building permit has been granted to the N. Y. Central & Hudson River R. R. Co. to erect a brick freight house on Portland Ave. at a cost of $40,000. A permit has also been granted to Wm. H. Rowerdink to erect a 4-story brick building, 54 x 202 ft., at a cost of $42,000.

Buffalo, N. Y.—The Cold Spring Storage Warehouse Co., it is stated, intends erecting a 6-story brick building at Main and Utica Sts. at a cost of $45,000.

**Niagara Falls, N. Y.*—W. N. Tobin, of Syracuse, it is reported, has secured the contract to ventilate and heat the engine house of the N. Y. Central & Hudson River R. R., at Suspension Bridge, the cost to be about $20,000.

Goldsboro, N. C.—H. E. Bonitz, of Wilmington, has prepared plans for a 3-story Odd Fellows' temple which is to be erected here at a cost of about $20,000. W. T. Hollowell, Chmn. Bldg. Com.

Ironton, O.—D. C. Davies and others, of Ironton, it is reported, have purchased a site bounded by 2d, 3d, and Vernon Sts. and Park Ave., and will erect a 5-story hotel.

Cleveland O.—The Hollenden Hotel, it is reported, is to be enlarged by the erection of a 10-story annex at a cost of $100,000.

Okeene, Okla. Ter.—Bids are wanted until Sept. 15 for erecting a 2-story brick building for the I. O. O. F. and K. of P. H. C. Harper, Secy. Bldg. Com.

Portland, Ore.—It is stated that Wells, Fargo & Co. will erect an 8-story brick building at 6th and Oak Sts., at a cost of $150,000, the upper floors to be used as offices for the Northern Pacific Ry., and the Oregon R. R. & Navigation Co.

Altoona, Pa.—The Morrison Co., it is stated, will erect a $100,000 hotel.

**Tarentum, Pa.*—Walker & Slater, it is stated, have secured the contract to erect the Masonic Temple at $30,000. Dean & Stophlet, Archts., Pittsburg.

**Pittsburg, Pa.*—The Pittsburg Harness Supply Co., it is stated, has awarded the contract to erect a warehouse at 325 Penn Ave. to the Geo. Hogg Co. Probable cost $150,000. Dean & Stophlet, 331 4th Ave., are the Archts.

Memphis, Tenn.—It is reported that improvements are to be made in the Royal Cafe at a cost of $75,000.

Dallas, Tex.—The Columbian Club has secured a site at Ervay and Pocahontas Sts., and it is stated that the Bd. of Directors will soon ask plans for erecting a club house to cost about $30,000.

Ft. Worth, Tex.—It is reported that M. D. Watson, prop. of the Delaware, is to be the manager of the 4-story hotel which it is proposed erecting at 2d and Main Sts., at a cost of about $100,000.

Seattle, Wash.—Bebb & Mendell, Denny Bldg., it is stated, have been engaged by Ferdinand Schmitz to prepare plans for a hotel, which is to be erected at Sans Souci at a cost of $100,000.

Spokane, Wash.—Cutter & Malgren, Exchange Bldg., are preparing plans for an addition to the Exchange National Bank, to cost $45,000.

Wheeling, W. Va.—Franzheim & Klieves, it is reported, have prepared plans for an 8-story business building which is to be erected at 1126 Main St., of granite and brick, by H. C. Franzheim for G. Mendel & Co., furniture dealers.

Milwaukee, Wis.—Ferry & Clas, 419 Bway., are the Archts. for the remodeling of the building at 3d St. and Grand Ave., which is to be occupied by Pabst Brewing Co. Probable cost $33,000.

NEW YORK, N. Y.

371 Greenwich St., 8-story br. and stone loft and warehouse; c, $125,000; o, Fischer Realty Co.; a, Jos. Wolf.

Mott and Grand Sts., 6-story br. and stone store and tenemt.; c, $35,000; o, Chas. I. Weinstein; a, Geo. F. Pelham.

310 E. 23d St., 12-story br. and stone loft bldg.; c, $225,000; o, E. W. Bliss Bldgs., Inc.; a, W. W. Knowles.

334 E. 33d St., 2 6-story br. and stone store and tenements; total c, $100,000; o, The Prudential Constr. Co.; a, Horenburger & Straub.

5th Ave. and 19th St., 8-story br. and stone store and loft bldg.; c, $300,000; o, City Investment Co.; a, John H. Duncan.

97th St. and Park Aves., 2 6-story br. and stone stores and tenemts.; total c, $96,000; o, Schlesinger & Fenichel; a, E. A. Meyers.

118th St. and 3d Ave., 6-story br. and stone store and tenemt.; c, $28,000; o, Schlesinger & Feinchel; a, Bernstein & Bernstein.

Amsterdam Ave. and 130th St., 4 6-story br. and stone stores and tenemts.; total c, $150,000; o, Geiger & Braverman; a, Neville & Bagge.

Amsterdam Ave. and 185th St., 2 6-story br. and stone stores and tenemts.; total c, $92,000; o, Altman Realty Co.; a. Geo. F. Pelham.

Brook Ave. and 165th St., 6-story br. stable; c, $35,000; o, Slawson & Decker Co.; a, F. A. Rooke.

Ogden Ave. and 161st St., 5-story br. store and tenement; c. $90,000; o, Egan & Hallecy Co.; a, Neville & Bagge.

Webster Ave. and 178th St., 3-story br. telephone exchange and offices; c, $75,000; o, N. Y. Telephone Co.; a, Eidlitz & McKenzie.

3d Ave. and 156th St., 2-story br. department store; c, $20,000; o, John Frees; a, M. J. Garvin.

Delancey and Orchard Sts., 6-story br. and stone extension to 6-story br. and stone store and tenemt.; c, $25,000; o, Abraham Elterman; a, Bernstein & Bernstein.

Bway and Fulton St., alterations to 5-story br. and stone store and office bldg.; c, $30,000; o, E. M. Knox; a, Jackson & Rosencrans.

169th St. and Amsterdam Ave., 2 5-story br. and stone stores and tenemts; total c, $85,000; o, Reliance Realty & Constr. Co.; a, Geo. F. Pelham.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Pasadena, Cal.—A $35,000 edifice is to be erected for the St. Andrews Episcopal Mission.

Gainesville, Ga.—The congregation of the First Methodist Church, it is reported, will erect a $20,000 edifice.

Chicago, Ill.—A. R. Boydell has had plans prepared by T. W. Wing, 185 Dearborn St., for a 3-story apartment building, 144 x 150 ft., to be built at 56th St. and Madison Ave. Cost, $100,000.

The Baptist Mission Society contemplates the erection of a church at Michigan Boule. and 56th St. No definite plans have so far been made, but the intention is to raise about $50,000 for building purposes.

A building permit has been issued to C. Parker to erect a 3-story apartment house at 5487 Lexington St., to cost $30,000; also for a Jewish Synagoguge, to be erected at 380 Marshfield Ave.; cost $50,000.

**Onarga, Ill.*—F. H. Jahr, of Urbana, it is reported, has received the contract to erect a $25,000 church here.

**Creston, Ia.*—W. W. Welch, of Clarinda, it is stated, has secured the contract to erect an edifice for the Church of the Immaculate Conception at $19,245.

Louisville, Ky.—A permit has been issued for a 5-story apartment house, which is to be erected by the Weissinger-Gaulbert Real Estate Co., as annex to the present apartment house at 3d Ave. and Bway., the cost to be about $85,000.

**Fairhaven, Mass.*—The Durantaye Constr. Co. has secured the contract to erect St. Joseph's Chapel for the Church of the Sacred Heart. Cost about $15,000. L. G. Destremps, Fall River, is the Archt.

Auburn, Neb.—Eisentraut-Pottenger-Colby Co., of Sioux City, Ia., it is reported, are preparing plans for a Presbyterian church, which is to be erected here at a cost of $18,000.

Cleveland, O.—P. H. Keevan, it is stated, has taken out a permit to erect a brick apartment house on E. Billings Ave., at an estimated cost of $14,000.

Oakmont, Pa.—It is reported that the members of the St. Thomas Episcopal Church intend erecting a $65,000 edifice. Rev. Lawrence McLure, Rector.

**Seattle, Wash.*—J. W. Coombs, it is reported, has received the contract to erect the Pilgrim Congregational Church at $15,000.

Tacoma, Wash.—W. R. Rust, Mgr. of the Tacoma smelter, it is stated, has taken out a permit to erect a residence at North I and 10th Sts., at a cost of $50,000. Miller & Biehm have the contract for the foundation; Russell & Babcock are the Archts.

Racine, Wis.—The members of the St. Stanislaus Church, it is stated, intend erecting a new edifice to cost $20,000.

Beloit, Wis.—It is reported that bids are wanted until Aug. 29 for erecting the First Presbyterian Church; probable cost, $35,000. H. C. Kock & Co., Archts., Milwaukee.

NEW YORK, N. Y.

68th St. and Ave. A, 6-story br. and stone tenemt.; c, $55,000; o, Forman & Aronson; a, Geo. F. Pelham.

1st Ave. and 100th St., 3 6-story br. and stone tenemts; total c, $138,000; o, Berliner & Greenberg; a, Bernstein & Bernstein.

143d St. and Bway, 6-story br. and stone tenemt; c, $125,000; o, T. J. McGuire Constr. Co.; a, Glosser & Ebert.

143d St. and Lenox Ave., 5-story br. and stone tenemt; c, $45,000; o, Lieberman & Rosenthal; a, Glosser & Ebert.

159th St. and Bway, 2 5-story br. and stone tenements; total c, $84,000; o, Jos. Newmark; a, John Hauser.

Bway and Terrace View Ave., 2 5-story br. and stone tenements; total c, $80,000; o, Chas. Weisbecker; a, Henry Anderson.

138th St. and Cypress Ave., 4 5-story br. tenements; total c, $120,000; o, Robt. Arnstein; a, John Hauser.

138th St. and Brook Ave., 3 6-story br. tenements; total c, $130,000; o, North Western Realty Co.; a, M. J. Garvin.

Brook Ave. and 138th St., 4 6-story br. tenements; total c, $160,000; o, North Western Realty Co.; a, M. J. Garvin.

168th St. and Forest Ave., 5-story br. tenement; c, $50,000; o, Hugh Kirk; a, J. C. Cocker.

Bathgate Ave. and 174th St., 5-story br. tenement; c, $42,000; o, Saml. Barkin; a, Edw. A. Meyers.

Prospect Ave. and 156th St., 5-story br. tenement; c, $45,000; o, Wm. Sugarman; a, Edw. A. Meyers.

Summit Ave. and 161st St., 2 5-story br. tenement; c, $130,000; o, Egan & Hallecy; a, Neville & Bagge.

15 E. 57th St., 4-story br. and stone extension to 4-story br. and stone dwelling; c, $40,000; o, R. T. Wilson; a, Hoppin, Koen & Huntington.

SCHOOLS.

Notes Arranged Alphabetically by States.

Fayetteville, Ark.—Bids will be received until Sept. 9 by H. F. Regan, Secy., Bd. Trus., Univ. of Arkansas, for erecting 5 brick and stone buildings and 1 stone building for the Univ. of Arkansas; estimated cost, $80,000. Chas. L. Thompson, Archt., Little Rock.

Hartford, Conn.—Bids will be received until Sept. 5 by the Bldg. Com., Hartford South School Dist. (Alex. Harbison, Chmn.) for erecting additions to schools on Babcock St. and New Park Ave.

Washington, D. C.—Bids will be received until Aug. 31 by the Comrs. D. C., for constructing the Francis L. Cardozo School on I St.

Tallahassee, Fla.—Edwards & Walter, of Columbia, S. C., are preparing plans for a school for Tallahassee.

Milledgeville, Ga.—The House has passed a bill appropriating $25,000 for the erection of a recitation building at the Georgia Normal and Industrial School for Girls at Milledgeville.

**Quincy, Ill.*—A. Roehl, it is stated, has secured the contract to erect an addition to the High School, at $52,499.

**Geneva, Ill.*—John Wheeler, of Geneva, it is reported, has received the contract to erect a school at $15,700.

Chicago, Ill.—The Trus. of the Univ. of Chicago, it is stated, contemplate erecting the following buildings: Complete library group, one building each for science, history, literature and arts, estimated cost, $1,500,000. Building for divinity school, cost $300,000. New auditorium for main campus, $300,000. A university church for main campus north of Cobb Hall, $300,000. Two medical buildings on Marshall Field, $400,000; women's gymnasium, $200,000, and completion of School of Education by duplicating the present building, $350,000.

Bloomington, Ind.—Archts. Patton & Miller, of Chicago, Ill., write that new bids will be received for erecting a library at the University of Indiana, as soon as plans and specifications can be revised.

Des Moines, Ia.—Plans are being prepared, it is stated, for a $30,000 music hall, which is to be erected at Des Moines College.

Frankfort, Ky.—Bids will be received until Aug. 31 by the Bd. Educ. (L. B. Marshall, Secy.) for erecting a 3-story, 12-room brick school. Leo. L. Oberwarth, Archt., Frankfort.

New Orleans, La.—Plans have been completed, according to reports, for a 2-story and basement brick parochial school which is to be erected on Patton St. by the congregation of St. Francis of Assisi Church (Rev. Father Brockmeier, Pastor) at a cost of $18,000.

Boston, Mass.—The following are reported to be the bids received Aug. 16 for furnishing granite for the new high school at Charlestown: Chase Granite Co., $71,740; Emerson Troy Granite Co., $77,300; H. E. Fletcher, $71,250; Jas. Lahey, $73,100; New England Granite Co., $58,000; Pigeon Hill Granite Co., 2 bids, $67,000 and $77,000; Rockport Granite Co., $87,000, and Angus McDonald, $98,877.

**Minneapolis, Minn.*—It is stated that the contract to erect the Lincoln School has been awarded to E. J. Davis, Northwestern Bldg., at $38,706.

*J. E. Pilgrim, it is stated, has secured the contract to erect the Hiawatha School at $15,885.

Boehme & Cordella, Kasora Bldg., have prepared plans for a 2-story and basement 8-room school which is to be erected by the Church of the Holy Cross at a cost of $35,000.

**Dillon, Mont.*—The following are reported to be the bids recently received for plumbing and heating in the main building and certain alterations in the old building of the State Normal College: Seattle Plumbing & Htg. Co., Seattle, Wash., $14,156; Wm. C. Bryant, Dillon, $13,512; Eschle Plumbing & Htg. Co., Butte, $11,920, and G. W. Dart Hardware Co., Dillon, $10,200 (awarded contract).

Manchester, N. H.—J. H. Mendell & Co., 1276 Elm St., it is stated, have received the contract to erect the Concord St. School at $36,749.

New York, N. Y.—Plans have been filed for a 5-story brick school to be erected at Anthony and Tremont Aves. for the City of New York, at a cost of $115,000. C. B. J. Snyder, Archt., 59th St. and Park Ave.

Items marked thus give the names of parties awarded contracts.

Brooklyn, N. Y.—Bids will be received until Sept. 5 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the general construction, etc., of temporary additions to School 54, Boro. Brooklyn.

Rush, N. Y.—All bids received by the Bd. Mgrs. for erecting 5 cottages, a reception house, hospital, bakery and store house at the Industrial School site at Rush, have been rejected, as they exceeded the appropriation which is $57,500.

Perry, N. Y.—The citizens have voted in favor of issuing $50,000 bonds to erect a school.

**Minot, N. D.*—D. A. Dinnie, it is reported, has received the contract to erect a school at $25,571 (bids received Aug. 8).

**Youngstown, O.*—Contracts have been awarded as follows for erecting a school on Myrtle Ave. (bids received Aug. 16): L. L. Beck, carpentry, etc., $12,372; W. A. Harper Lumber Co., masonry, $15,660; W. H. Burnett Co., plumbing, $2,835, and Bartlett Bros., heating, $4,166.

Mansfield, O.—Bids will be received until Sept. 5 by the Bd. Educ. of the City School Dist. (W. C. Mowry, Clk.) for $16,000 school improvement bonds.

Shawnee, Okla. Ter.—Bids willl be received until Sept. 14 by the Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing materials and constructing 2 brick dormitories and 1 mess hall and water and sewer system at the Shawnee School; for further information apply to F. A. Thackery, Supt., Shawnee.

Salt Lake City, Utah.—The Bd. of Educ. of the Granite School Dist. of Salt Lake City (Amos Gabbott, Pres.) will soon ask bids for erecting a school at Pleasant Green, to cost $11,000.

**Monti, Utah.*—Grace Bros., of Nephi, Utah, it is reported, have secured the contract to erect the high school at $12,975.

**La Crosse, Wis.*—The Bd. of Educ., it is stated, has awarded contracts for erecting the high school as follows: Plumbing, Thill & Lapitz, La Crosse, $9,096; heating, Thomas & Smith, Chicago, Ill., $16,485; wiring, Kohler Bros., Chicago, Ill., $3,081, and general bldg., Dwinnell & Loughlin, Waukesha, $109,661.

**North Milwaukee, Wis.*—J. A. Silber, of Appleton, it is stated, has received the general contract for the erection of the high school. The total cost of the school is to be about $24,870. Van Ryn & De Gelleke, Archts., Milwaukee.

Oneida, Wis.—Bids will be received until Sept. 22 by the Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing materials, constructing, plumbing, electric lighting and steam heating a brick school at this place; Jos. C. Hart, Supt.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Paducah, Ky.—The Bd. of Pub. Wks. is reported to have under consideration the construction of a garbage crematory.

**Kansas City, Mo.*—The contract for the collection of the city's garbage is stated to have been awarded by the Bd. of Health to L. P. Elberg, of Kansas City, at $3,006 per month for the summer months and $1,578 per month for the winter months, making a total of $27,504 for the year. The other bids were W. B. Vining, $28,492 per yr., and the Interstate Live Stock Comn. Co., $28,850.

Columbus, O.—Engr. Howard G. Bayles, of New York, who has been studying the question of garbage disposal in various cities, is stated to have reported that Columbus should be able to build a garbage incinerating plant at a cost of from $60,000 to $80,000 and dispose of its entire waste, including all sorts of garbage, dead animals and the like at a cost not to exceed 30 cts. per ton each day.

NEW INDUSTRIAL PLANTS.

See also Business' Building.

The Gaston Plaster Co., Gastonia, S. C., is erecting a new plaster factory, and is in the market for a platform elevator.

Mr. C. D. Davis, Hawkinsville, Ga., is planning to increase the daily capacity of his present ice plant about ten tons.

Southern Spindle & Flyer Co., Charlotte, N. C., has been incorporated for the manufacture of spindles, flyers, steel rolls and pressers, and the repairing and general overhauling of cotton mill machinery. The officers of the company are T. M. Costello, Prest.; W. H. Monty, Treas.; A. Guillett, Secy.

TheMidgley Mfg. Co., Columbus O., is erecting a new plant, which will consist of two buildings, 1200 x 50 ft. and 700 x 75 ft. respectively. Power plant to be contracted for will consist of one 65 hp. and one 35 hp. gas engine and three 20 hp. electric motors.

Wisconsin Attachable Ball-Bearing Hub Co., Milwaukee, Wis., has acquired mill property in that city for the manufacture of steel wagon skeins and ball-bearing attachments for vehicles. A 60 hp. power plant will be installed, together with lathes, screw and milling machinery, presses, and other necessary equipment.

Shaw Machine Co., Lowell, Mass., Frederick P. Shaw, Gen. Mgr., is contemplating the erection of a plant for the manufacture of worsted machinery. This company has only recently been incorporated and plans for the new plant have not yet been fully worked out.

A. L. Young and others, of Paris, Ky., are preparing plans for the erection of a $50,000 plant for the manufacture of the Young self-dumping box, according to local newspaper reports.

Beacon Mfg. Co., New Bedford, Mass., will shortly begin the erection of a $200,000 addition to their present plant, according to local newspaper reports.

M. J. Helfrich and others, of Evansville, Ind., will, it is reported, erect a new factory building.

Steul & Shumann, Buffalo, N. Y., will erect a new factory building to cost $12,000, according to local newspaper reports.

Protective Bottle Co., Los Angeles, Cal., Jas. C. Henderson, Prest., has completed plans for a new bottle factory, according to local newspaper reports.

F. L. McLean, Buffalo, N. Y., is interested in a new feed mill to cost $20,000 and have a capacity of 3,000 bushels per day, according to local newspaper reports.

Standard Sanitary Mfg. Co., Detroit, Mich., has acquired a site for the erection of several large factory buildings, according to local newspaper reports.

Plans have been prepared by the Burtt Mfg. Co., Kalamazoo, Mich., for an addition to their present plant, according to local newspaper reports.

The Capital Grain Co., Nashville, Tenn., is reported to have completed plans for the erection of a 12,000 bushel grain elevator, to cost $15,000.

J. R. Hale & Sons, Nashville, Tenn., will erect a grain elevator having a capacity of 20,000 bushels and costing $25,000, according to local newspaper reports.

The Thieme & Wagner Brewing Co., Lafayette, Ind., will erect a $70,000 addition to its plant, according to local newspaper reports.

The Impervious Product Co., Baltimore, Md., has awarded to John H. Geis & Co., Brooklyn, Md., contract for the rebuilding of its plant at Fairfield, Md. Buildings will cover 150x250 ft., and will be equipped with modern machinery throughout.

Colonial Mfg. Co., Abingdon, Va., is constructing a new plant to consist of two frame buildings measuring 40x160 ft. and 30x60 ft., respectively. This company is in the market for 1 double-surface pony planer, 24x6 or 24x8, with in-feed and out-feed rolls; 1 power feed rip saw mill in and out-feed rools; 1 swing cut-off saw; also lead screw on carriage and cone pulleys for 18 ft. bed screw cutting engine lathe.

Mr. R. C. Flint, Ballard, Wash., has purchased land at Walla Walla, Wash., and is contemplating the erection in the near future of a cold-storage plant.

Mr. Jas. A. Moore, Seattle, Wash., is planning the erection of a blast furnace having a capacity of about 300 tons.

Berwick (La.) Ice & Fuel Co. is erecting a 17-ton ice plant. The building will measure 50x90 ft.

Catogni Bros., Roanoke, Va., will erect a wood-working plant having a capacity of about 20,000 ft. per day and consisting of main building 60x100 ft., stock house 250x20 ft., and lumber sheds 2,000x20 ft. A complete equipment of wood-working machinery will be installed.

Western Gas Engine Co., Los Angeles, Cal., has purchased a site for the erection of a modern gas engine manufacturing plant. The new plant will consist of foundry, machine shops, testing and finishing departments, etc.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

England, Ark.—Bids will be received until Sept. 14 by the Plum Bayou Levee Board (J. T. Lipscomb, Secy.) for constructing a new levee from Station 1,651 to Station 1,950, containing approximately 260,000 cu. yds.

**Walnut Hill, Ark.*—Chas. L. Vasseur, Ch. Engr. Long Prairie Levee Bd., Randolph Bldg., Memphis, Tenn., writes that the following are the bids opened on Aug. 8 for constructing levee from Bunkham Springs, Ark., to the La. State line, 700,000 cu. yds.; *a* price per cu. yd., *b* total: Talley-Bates Construct. Co., Memphis, Tenn., *a* 17.99 cts.; *b* $125,930 (awarded contract). S. S. Hunter & Co., Shreveport, La., *a* 20.5 cts.; *b* $143,500.

San Francisco, Cal.—Bids will be received until Oct. 3 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the Navy Yard, Mare Island, Cal., a quantity of machine tools, including bending roll machine, lathes, drills, grinder, crane and furnace. H. T. B. Harris, Paymaster Gen., U. S. N.

Los Angeles, Cal.—The following are the bids opened on Aug. 10 by Capt. C. H. McKinstry, Corps Engrs., U. S. A., for dredging Wilmington Harbor, Cal.: 160,000 cu. yds. (price given per cu. yd.): Pacific Coast Dredging & Reclamation Co., San Francisco, 63.74 cts.; North American Dredging Co., San Francisco, 49.74 cts.; A. A. Polliamus, San Diego, 46 cts.; Atlantic, Gulf & Pacific Co., San Francisco, 82 cts.; Marshall C. Harris, San Francisco, $1.10, and Walter M. Willett and W. A. Bole, San Francisco, 84⅛ cts.

Sacramento, Cal.—It is stated that bids will be received until about Sept. 2 by Thomas B. Hall, Secy. Aud. Bd., State Bd. Pub. Wks., for furnishing material and constructing a brush mattress and sinking it to position in Sacramento River; principal items in the work are 3,700 cu. yds. brush fascines, 3,500 tons rock and 6,000 lbs. of wire.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received until Aug. 29 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Steel standpipe; radiators; iron pipe and fittings; nickel-steel shields; battery cells; telephone cable; condenser tubes, etc.; also Sept. 19, to furnish at the navy yards, etc., Boston, Mass.; New York, N. Y.; Annapolis, Md.; Norfolk, Va.; Pensacola, Fla., and New Orleans, La., a quantity of machine tools, as follows: water-tube boilers; locomotives; radial drill; electric hoist and runway; engine, lathes, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Washington, D. C.—The following are the bids opened on Aug. 22 by the Superv. Archt., Treas. Dept., for an electric passenger and freight elevator in the West Out Bldg., Bureau of Engraving and Printing: Marine Engine & Machine Co., New York, N. Y., $4,483, and Otis El. Co., New York, N. Y., $3,850.

The following are the bids opened on Aug. 21 by the Comrs. D. C., for furnishing a 15-ton electric traveling crane for the sewage pumping station: The Case Mfg. Co., $5,675; the North Penn Iron Co., $6,283; Whiting Foundry Equipment Co., $6,680, and Pawling & Harnischfeger, $7,000.

Col. Smith S. Leach, Corps Engrs., U. S. A., in his report for the fiscal year, is stated to have petitioned for a larger appropriation for dredging Potomac River and building Potomac Park.

**Tampa, Fla.*—The Atlantic, Gulf & Pacific Dredging Co., of San Francisco, Cal., is stated to have secured the contract for the continuation of work on deep water channel for Tampa, for about $400,000.

Prophetstown, Ill.—It is stated that bids will be received until Sept. 4 by Mason P. Brewer, Drainage Comr., Prophetstown, for the excavating work consisting of 2.52 miles of cleaning, deepening and widening old ditch, 25,749 cu. yds. in all, and 3.85 miles of excavation of new ditch requiring 71,813 cu. yds. excavating.

**Ottawa, Ill.*—Mr. McWilliams, of Earlville, is stated to have secured the contract for constructing a drainage ditch in Ophir Township at 12½ cts. per cu. yd. About 200,000 cu. yds. of dirt will be removed.

Indianapolis, Ind.—E. M. Graves, 57 Lombard Bldg., has about 600,000 yds. of excavation to sub-let at good prices.

Winchester, Ind.—It is reported that bids will soon be received for the construction of 12 miles of ditch; also about Sept. 15 for 4½ miles of ditch; total cost of work proposed $69,000.

**Storm Lake, Ia.*—The contract for the Prairie Creek drainage ditch is reported to have been awarded by the Bd. of Supervisors to W. F. Cook, of Des Moines, at 12.9 cts. per cu. yd. There will be approximately 200,000 cu. yds. of dirt removed.

Ft. Dodge, Ia.—It is stated that bids will be received until Sept. 5 by H. S. Holm, Co. Aud., for constructing 5 drains, requiring the excavating of about 1,838,384 cu. yds.

Des Moines, Ia.—It is stated that bids will be received until Sept. 11 by Lew Burnett, Co. Aud., for constructing the Saylor Township ditch, requiring about 33,073 cu. yds. of earth excavation.

Bossier, La.—Bids will be received until Nov. 5 by the Bossier Levee Comrs., for $50,000 bonds. For further particulars apply to T. N. Braden, Jr., Secy., Curtis, La.

New Orelans, La.—Bids will be received until Sept. 1 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., for constructing about 158,700 cu. yds. levee work in the Lake Borgne Dist.

Boston, Mass.—The lowest bids opened on Aug. 17 by City Engr. Wm. Jackson for the iron railing of Atlantic Ave. extension was submitted by Jas. Russell Boiler Wks. Co., of East Boston, for $5,485.

Detroit, Mich.—The M. Mitshkun Co., Mfrs. of Railway Equipment, are in the market for 30 wheel scrapers.

Charlevoix, Mich.—Bids will be received until Sept. 20 by Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids, for repair of pier and revetments at Charlevoix, Mich., as advertised in The Engineering Record.

New York, N. Y.—Bids will be received until Sept. 9 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging in Bronx River, Harlem River and Browns Creek, N. Y., as advertised in The Engineering Record.

Bids will be received until Sept. 1 by the Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing, delivering and putting in place about 15,000 cu. yds. of small cobblestone and about 20,000 cu. yds. rip-rap stone; for furnishing and delivering about 3,000 cu. yds. sand and about 7,500 cu. yds. broken stone, all in Boro. Manhattan; also for furnishing materials and dredging about 100,000 cu. yds. on the East and Harlem Rivers, etc., Boros. Manhattan, Brooklyn, Queens, Bronx and Richmond.

New York, N. Y.—The following are the bids opened on Aug. 23 by the Superv. Archt., Treas. Dept., Washington, D. C., for installing an electric freight elevator in the U. S. Postoffice and Court House in New York: Marine Engine & Machine Co., New York, N. Y., $5,512, and Otis Elevator Co., New York, N. Y., $6,690.

Bids will be received until Sept. 7 by Geo. E. Best, Comr. Bridges, for furnishing and delivering electrical tools and supplies, Williamsburg Bridge.

Brooklyn, N. Y.—Bids will be received until Sept. 7 by the Park Comrs. (John J. Pallas, Pres.) for furnishing and delivering 4,500 cu. yds. top soil to Fulton and Highland Parks; 2,000 cu. yds. fine gravel to Ocean Parkway, all in Boro. Brooklyn; also 250 bbls. Portland cement, 500 cu. yds. building sand and 20,000 paving brick, to Forrest and Prospect Parks, Boros. Brooklyn and Queens.

New Brighton, S. I., N. Y.—Bids will be received until Sept. 6 by the Bd. Health (Thos. Darlington, M. D., Pres.) New York City, for furnishing all the labor and furnishing and delivering all the materials required to ditch, drain, fill or otherwise improve certain areas in the salt marsh lands located within the Boro. Richmond for the destruction of mosquitoes.

**Portland, Ore.*—Smyth & Jones, of Portland, are stated to have secured the contract for constructing The Dalles-Celilo Canal on upper Columbia River (bids opened July 24) for $294,262. For detail list of bids received for this work, see issue of The Engineering Record Aug. 12.

Panama.—Bids will be received until Sept. 12 by D. W. Ross, Genl. Purchasing Agent, Isthmian Canal Comn., Washington, D. C., for furnishing 20,000 bbls. Portland cement.

The following are the bids opened on Aug. 19 by the Isthmian Canal Comn., Washington, D. C., for two dipper dredges, (*a*) one to be delivered in La Boca, (*b*) one to be delivered in Cristobal: Bucyrus Steam Shovel Co., Milwaukee, Wis., *a* $184,000, *b* $156,000; G. W. Catt, New York, N. Y., for both, total $205,000, and Featherstone Fdy. & Machine Co., Chicago, Ill., *a* $159,000, *b* $122,000.

Newport, R. I.—The following are the bids opened on Aug. 18 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., for dredging in Woods Hole Channel, price given per cu. yd. (amount available $69,950); J. S. Packard Dredging Co., Providence, $2.73; Chas. M. Cole, Fall River, Mass., $2.97; The International Contr. Co., New York, N. Y., $5; The W. H. Beard Dredging Co., New York, N. Y., $3.90; Morris & Cummings Dredg-

**Items marked thus give the names of parties awarded contracts.*

ing Co., New York, N. Y., $3.89; R. G. Packard Co., New York, N. Y., $1.74, and Daly & Hannan Dredging Co., Ogdensburg, N. Y., $3.09.

Galveston, Tex.—Capt. Edgar Jadwin, Corps Engrs., U. S. A., is stated to have completed plans for the Parson slough dam, to be constructed about 20 miles below Dallas; it will cost about $45,000.

National Soldiers' Home, Va.—Bids will be received until Sept. 12 at the N. H. D. V. S. (B. A. Beeson, Treas.) for dredging about 2,000 cu. yds. in Jones' Creek.

Wheeling, W. Va.—Bids will be received until Sept. 22 by Maj. Geo. A. Zinn, Corps. Engrs., U. S. A., for furnishing and delivering steel trestles for dams on Kanawha River.

PROPOSALS OPEN

For Proposals see pages 56, 60, 61 AND 63,

WATER WORKS.

Bids Close.		See Eng. Record.
Aug. 29.	Pipe, etc., Cincinnati, O.	Aug. 12
Aug. 29.	Mains, Marion, Ind.	Aug. 19
Aug. 29.	Pipe, Harrisburg, Pa.	Aug. 26
Aug. 30.	Engine, Perth Amboy, N. J. Adv. Aug. 19.	Aug. 19
Aug. 30.	Pipe hydrants, etc., Garfield, N. J. Adv. Aug. 26.	Aug. 26
Aug. 30.	Pipe, Chicago, Ill.	Aug. 26
Aug. 30.	Pipe, Marietta, O.	Aug. 26
Aug. 31.	Water-wks., Owensboro, Ky.	Aug. 12
Aug. 31.	Improv., Salt Lake City, Utah	Aug. 19
Aug. 31.	Water Wks., Banff, Alta	Aug. 19
Aug. —.	Improv., Donalsonville, La.	Jul. 15
Sep. 1.	Water works, Barnesville, Minn	Aug. 19
Sep. 1.	Pipe, etc., Hayfield, Minn	Aug. 26
Sep. 2.	Pumping unit, Niagara Falls, Ont. Adv. Aug. 5, 12.	Aug. 5
Sep. 2.	Boiler, Ft. Brown, Tex	Aug. 12
Sep. 2.	Chimney, Erie, Pa	Aug. 12
Sep. 4.	Conduit, Salt Lake City, Utah Adv. Aug. 12 to 26.	Aug. 12
Sep. 4.	Reservoir, Wilmington, Del. Adv. Aug. 12, 19.	Aug. 12
Sep. 4.	Mains, reservoir, etc., Ames, Ia. Adv. Aug. 19.	Aug. 19
Sep. 4.	Laying pipe, Falmouth, Mass. Adv. Aug. 26.	Aug. 26
Sep. 4.	Water wks. exten., Sudbury, Ont.	Aug. 26
Sep. 4.	Water wks., Carbon Hill, Ala.	Aug. 26
Sep. 4.	Pump, Thief River Falls, Minn.	Aug. 26
Sep. 5.	Dam, etc., Cody, Wyo Adv. Jul. 15 to Aug. 5.	Jul. 15
Sep. 5.	Standpipe, Stromsburg, Neb.	Aug. 12
Sep. 5.	Irrig. Canal, Turlock, Cal.	Aug. 19
Sep. 5.	Conduit, etc., Richmond, Va.	Aug. 19
Sep. 5.	Water Wks., Princeton, Ky.	Aug. 26
Sep. 5.	Dam, Columbia, Pa. Adv. Aug. 26.	Aug. 26
Sep. 6.	Tunnel, etc., Cody, Wyo Adv. Jul. 15 to Aug. 5.	Jul. 15
Sep. 6.	Collectors, etc., Philadelphia, Pa. Adv. Aug. 12 to 26.	Aug. 19
Sep. 6.	Tunnel, etc., Chicago, Ill.	Aug. 26
Sep. 6.	Reservoir, Ft. McPherson, Ga. Adv. Aug. 26.	Aug. 26
Sep. 6.	Water wks. improv., Dover, Pa. Adv. Aug. 26.	Aug. 26
Sep. 6.	Mains, New York, N. Y.	Aug. 26
Sep. 6.	Engines, mains, etc., Brooklyn, N. Y.	Aug. 26
Sep. 7.	System at school, Toledo, O.	Aug. 12
Sep. 7.	Mains, Norfolk, Neb.	Aug. 19
Sep. 11.	Well, Ft. Hancock, N. J.	Aug. 19
Sep. 11.	Conduit, Toledo, O.	Aug. 26
Sep. 13.	System, Southern Pines, N. C.	Aug. 19
Sep. 14.	Pumping machinery, Columbus, O. Adv. Aug. 5 to 26.	Aug. 5
Sep. 14.	System, Shawnee, Okla. Ter.	Aug. 26
Sep. 15.	Tank, etc., Ft. Myer, Va. Adv. Aug. 26.	Aug. 26
Sep. 18.	C. I. Pipe, Victoria, B. C.	Aug. 19
Sep. 19.	Pumps, etc., Toronto, Ont. Adv. Aug. 5 to 19.	Aug. 5
Sep. 19.	Pump, engine, Burlington, N. J Adv. Aug. 26.	Aug. 26
Sep. 21.	Pump, sta., Galveston, Tex.	Aug. 26
Sep. 25.	Water wks., Glendive, Mont.	Aug. 26
Sep. 26.	Tunnel, Montrose, Colo. Adv. Aug. 12 to 26.	Aug. 12
Sep. 28.	Tank, Vancouver Barracks, Wash. Adv. Aug. 26.	Aug. 26
Sep. 30.	Pipe laying, Perth Amboy, N. J.	Aug. 26
Sep. —	Water Wks., E. Grand Forks, Minn.	Aug. 19
Sep. —	Water works, Jackson, Mo.	Aug. 19
Sep. —	Reservoir, McLeansboro, Ill.	Aug. 26
Oct. 12.	Sale of standpipe, Attleboro, Mass. Adv. Jul. 29 to Aug. 5.	Jul. 29
Oct. 17.	Embankment, Roswell, N. M. Adv. Aug. 26.	Aug. 26
———	Water wks. or franchise, Muncie, Ind. Adv. Jul. 29.	Jul. 29

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 28.	New York, N. Y.	Aug. 19
Aug. 28.	New Brunswick, N. J.	Aug. 19
Aug. 29.	Cleveland, O.	Aug. 19
Aug. 29.	Watertown, Wis.	Aug. 19
Aug. 29.	Bound Brook, N. J.	Aug. 26
Aug. 30.	Marietta, O.	Aug. 26
Aug. 30.	Washington, D. C.	Aug. 26
Aug. 31.	Chicago, Ill.	Aug. 19
Aug. 31.	Banff, Alta.	Aug. 19
Aug. 31.	Long Island City, L. I., N. Y.	Aug. 26
Aug. 31.	Coshocton, O.	Aug. 26
Sep. 1.	Kenton, O.	Aug. 5
Sep. 1.	South Bend, Ind.	Aug. 12
Sep. 1.	Roanoke, Va.	Aug. 19
Sep. 1.	Buffalo, N. Y.	Aug. 26
Sep. 1.	North York, Pa.	Aug. 26
Sep. 1.	Cincinnati, O.	Aug. 26
Sep. 1.	St. Joseph, Mo.	Aug. 26
Sep. 2.	Newton, N. J. Adv. Aug. 12 to 26.	Aug. 12
Sep. 4.	Lawrence, Kan. Adv. Aug. 26.	Aug. 26
Sep. 4.	Sudbury, Ont.	Aug. 26
Sep. 5.	Harrison, N. J.	Aug. 12
Sep. 5.	Centerville, Ia.	Aug. 26
Sep. 6.	New Hampton, Ia.	Aug. 26
Sep. 6.	Owosso, Mich. Adv. Aug. 26.	Aug. 26
Sep. 7.	Washington, D. C. Adv. Aug. 26.	Aug. 26
Sep. 7.	Delaware, O.	Aug. 26
Sep. 9.	Boise, Idaho	Aug. 26
Sep. 11.	Willoughby, O.	Aug. 19
Sep. 12.	Nevada, Mo.	Aug. 26
Sep. 13.	Lexington, Ky. Adv. Aug. 26.	Aug. 26
Sep. 13.	Brooklyn, N. Y.	Aug. 26
Sep. 14.	Shawnee, Okla. Ter.	Aug. 26
Sep. 15.	Ft. Worth, Tex.	Aug. 26
Sep. 19.	Southern Pines, N. C.	Aug. 19
Sep. 25.	Glendive, Mont.	Aug. 26

BRIDGES.

Aug. 29.	Zanesville, O.	Aug. 19
Aug. 29.	Indianapolis, Ind.	Aug. 26
Aug. 29.	Spartanburg, S. C.	Aug. 26
Aug. 30.	Pittsfield, Mass.	Aug. 26
Sep. 1.	Cordell, Okla. Ter.	Aug. 26
Sep. 2.	Norristown, Pa.	Aug. 12
Sep. 4.	Mandan, N. D.	Aug. 12
Sep. 4.	Springfield, Ill.	Aug. 26
Sep. 4.	Neosho, Mo.	Aug. 26
Sep. 4.	Jamestown, N. D.	Aug. 26
Sep. 5.	Columbus, O.	Aug. 12
Sep. 6.	Colusa, Cal.	Aug. 26
Sep. 7.	Norwalk, O.	Aug. 26
Sep. 7.	Delaware, O.	Aug. 26
Sep. 8.	Virginia City, Mont.	Jul. 26
Sep. 8.	Albany, Ore.	Aug. 26
Sep. 11.	Chillicothe, O.	Aug. 26
Sep. 16.	Washington, D. C. Adv. Aug. 26.	Aug. 26
Sep. 30.	San Juan, P. R.	Aug. 5
Sep. 30.	San Juan, Porto Rico Adv. Aug. 26.	Aug. 26
Oct. 1.	Pensacola, Fla.	Aug. 12
Oct. 4.	Superstructure, Chicago, Ill.	Aug. 12
Oct. 4.	Substructure, Chicago, Ill.	Aug. 12

PAVING AND ROADMAKING.

Aug. 28.	Long Island City, L. I., N. Y.	Aug. 19
Aug. 28.	Carrick, Pa.	Aug. 26
Aug. 28.	Herkimer, N. Y.	Aug. 26
Aug. 28.	Union, N. J.	Aug. 26
Aug. 29.	Cleveland Heights, O.	Aug. 12
Aug. 29.	Portsmouth, O. Adv. Aug. 19 to 26.	Aug. 19
Aug. 29.	Zanesville, O.	Aug. 19
Aug. 29.	New Castle, Del.	Aug. 19
Aug. 29.	Troy, N. Y.	Aug. 19
Aug. 29.	Hamden, Conn.	Aug. 26
Aug. 30.	Madison, Wis.	Aug. 12
Aug. 30.	Marion, O.	Aug. 19
Aug. 30.	Chicago, Ill.	Aug. 26
Aug. 30.	Dover, O.	Aug. 26
Aug. 31.	Long Island City, L. I., N. Y.	Aug. 26
Aug. 31.	Towson, Md.	Aug. 26
Aug. 31.	Toledo, O.	Aug. 26
Aug. 31.	Jackson, O.	Aug. 26
Sep. 1.	Ft. Hancock, N. J.	Aug. 12
Sep. 1.	Wallace, Idaho	Aug. 12
Sep. 1.	Elizabeth, N. J.	Aug. 19
Sep. 1.	Indianapolis, Ind.	Aug. 26
Sep. 1.	Barnstable, Mass.	Aug. 26
Sep. 1.	Troy, N. Y.	Aug. 26
Sep. 1.	Cincinnati, O.	Aug. 26
Sep. 1.	Sullivan, Ind.	Aug. 26
Sep. 2.	Harrisburg, Pa.	Aug. 26
Sep. 4.	Lancaster, Pa.	Aug. 26
Sep. 4.	East Palestine, O.	Aug. 26
Sep. 4.	Greencastle, Ind.	Aug. 26
Sep. 5.	Norwalk, O.	Aug. 5
Sep. 5.	Harrison, N. J.	Aug. 12
Sep. 5.	Columbus, O.	Aug. 12
Sep. 5.	Cincinnati, O.	Aug. 12
Sep. 5.	Bellevue, Pa.	Aug. 26
Sep. 5.	Brownstown, Ind.	Aug. 26
Sep. 5.	Toledo, O.	Aug. 26
Sep. 5.	Bisbee, Ariz.	Aug. 26
Sep. 5.	Wilmington, Del.	Aug. 26
Sep. 5.	Bayonne, N. J. Adv. Aug. 26.	Aug. 26
Sep. 6.	Cincinnati, O.	Aug. 19
Sep. 6.	Mercer, Pa.	Aug. 26
Sep. 6.	Providence, R. I.	Aug. 26
Sep. 6.	Dayton, O.	Aug. 26
Sep. 7.	Brooklyn, N. Y.	Aug. 26
Sep. 7.	Iola, Kan.	Aug. 26
Sep. 10.	Shelbina, Mo.	Aug. 19
Sep. 11.	Janesville, Wis.	Aug. 19
Sep. 11.	South Orange, N. J.	Aug. 26
Sep. 12.	Crookston, Minn. Adv. Aug. 26.	Aug. 26
Sep. 15.	Cincinnati, O.	Aug. 10
Sep. 18.	Willoughby, O.	Aug. 26

POWER, GAS AND ELECTRICITY.

Aug. 29.	Supplies, Pensacola, Fla.	Aug. 12
Aug. 29.	Boilers, etc., Washington, D. C.	Aug. 12
Aug. 30.	St. Louis, Mo.	Aug. 26
Aug. 31.	New York, N. Y.	Aug. 26
Aug. —.	Waukegan, Ill.	Jul. 29
Sep. 1.	Middleburg, Pa.	Aug. 26
Sep. 4.	Carbon Hill, Ala.	Aug. 26
Sep. 5.	Supplies, Washington, D. C.	Aug. 12
Sep. 5.	Washington, D. C.	Aug. 26
Sep. 5.	Burlington, Wis.	Aug. 26
Sep. 6.	Ukiah, Cal.	Aug. 5
Sep. 15.	La Grange, Ga. Adv. Aug. 12 to 26.	Aug. 26
Sep. 19.	Washington, D. C.	Aug. 26
Sep. 30.	Washington, D. C. Adv. Aug. 5.	Aug. 5
Oct. 1.	**Tacoma, Wash.**	**Jul. 8**
Oct. 11.	Lockport, Ill.	Aug. 19
Oct. 15.	Reading, O.	Aug. 26
Dec. 2.	San Juan, Porto Rico	Aug. 19

BUILDINGS.

Aug. 28.	Hospital bldgs., Buffalo, N. Y.	Jul. 29
Aug. 28.	Post bldgs., Ft. DuPont, Del. Adv. Aug. 5 to 19.	Aug. 5
Aug. 28.	Schools, Brooklyn, N. Y.	Aug. 19
Aug. 28.	Post Bldg., Ft. Mott, N. J.	Aug. 26
Aug. 29.	School addition, Lakewood, O.	Aug. 5
Aug. 29.	Church, Beloit, Wis.	Aug. 26
Aug. 30.	School, Orange, N. J.	Aug. 19
Aug. 30.	Hospital, Ellis Island, N. Y. Harbor	Aug. 19
Aug. 31.	School, Durham, N. C.	Aug. 19
Aug. 31.	School, Chilocco, Okla. Ter.	Aug. 19
Aug. 31.	Htg. P. O., Burlington, Vt.	Aug. 19
Aug. 31.	School, Frankfort, Ky.	Aug. 26
Aug. 31.	Htg. police sta., New York, N. Y.	Aug. 26
Aug. 31.	Post bldg., Ft. Ontario, N. Y.	Aug. 26
Aug. 31.	School, Washington, D. C.	Aug. 26
Aug. 31.	Engine house, New Haven, Conn.	Aug. 26
Sep. 1.	City hall, plans, Regina, N. W. Ter.	Aug. 5
Sep. 1.	School, Detroit, Mich.	Aug. 12
Sep. 1.	Pub. bldg., La Crosse, Wis.	Aug. 12
Sep. 2.	School, Lyons, Ia.	Aug. 19
Sep. 2.	Htg., etc., infirmary, Salt Lake City, Utah	Aug. 26
Sep. 4.	Htg., etc., courthouse, Huntington, Ind.	Jul. 29
Sep. 4.	Hospital, Little Rock, Ark.	Aug. 12
Sep. 4.	Court house, North Yakima, Wash.	Aug. 26
Sep. 4.	Jail, Monks Corner, S. C.	Aug. 26
Sep. 4.	Found. for C'rt House, Portland, Me.	Aug. 26
Sep. 4.	Htg. jail, Aberdeen, Miss.	Aug. 26
Sep. 5.	School, Salem, Ore.	Aug. 19
Sep. 5.	School, Hartford, Conn.	Aug. 26
Sep. 5.	Pub. bldg., New York, N. Y.	Aug. 26
Sep. 5.	School, Brooklyn, N. Y.	Aug. 26
Sep. 5.	Hospital improv., Sonyea, N. Y.	Aug. 26
Sep. 7.	Hospital, Jersey City, N. J.	Aug. 12
Sep. 7.	School, Toledo, O.	Aug. 19
Sep. 8.	Hospital, Whipple Barracks, Ariz. Adv. Aug. 19 to 26.	Aug. 19
Sep. 9.	Pub. bldg., Philadelphia, Pa.	Aug. 12
Sep. 9.	School, Fayetteville, Ark.	Aug. 26
Sep. 11.	Post Bldgs., San Francisco, Cal.	Aug. 19
Sep. 13.	Pub. Bldgs., Baltimore, Md.	Aug. 19
Sep. 14.	Bus. bldg., St. Louis, Mo.	Aug. 5
Sep. 14.	Lighthouse, Ft. Schuyler, N. Y. Adv. Aug. 12, 19.	Aug. 12
Sep. 14.	School, Shawnee, Okla. Ter.	Aug. 26
Sep. 15.	Pub. bldg., material, Ft. Totten, N. Y. Adv. Aug. 26.	Aug. 26
Sep. 15.	Bus. bldg., Okeene, Okla. Ter.	Aug. 26
Sep. 16.	Pub. bldg., Cleveland, O.	Aug. 26
Sep. 18.	Pub. bldg., Duluth, Minn. Adv. Aug. 26.	Aug. 26
Sep. 18.	Pub. Bldg., Erie, Pa.	Aug. 26
Sep. 19.	Capitol, Bismarck, N. D.	Aug. 19
Sep. 20.	Court House, Akron, O.	Aug. 19
Sep. 22.	School, Oneida, Wis.	Aug. 26
Sep. 30.	Htg., etc., pub. bldg., Washington, D. C. Adv. Aug. 5 to 26.	Aug. 5
Oct. 1.	Hospital, Memphis, Tenn.	Aug. 26
Oct. 2.	Repairing court house, Rosedale, Miss.	Aug. 26
Oct. 2.	Htg. jail, Cleveland, Miss.	Aug. 26
Oct. 5.	Courthouse, Manhattan, Kan.	Aug. 12

MISCELLANEOUS.

Aug. 29.	Machines, etc., San Francisco, Cal.	Jul. 29
Aug. 29.	Supplies, Pensacola, Fla.	Aug. 12
Aug. 29.	Wharf, Astoria, Ore.	Aug. 19
Aug. 29.	Supplies, Washington, D. C.	Aug. 26
Aug. 30.	Breakwater, Newport, R. I. Adv. Aug. 5 to 26.	Aug. 5
Aug. 31.	Lock and dam, Nashville, Tenn. Adv. Aug. 5 to 26.	Aug. 5
Aug. 31.	Dredging, Portland, Me. Adv. Aug. 5 to 26.	Aug. 5
Sep. 1.	Steel and iron, Sydney, N. S. Wales. **Adv. Apr. 8, 22; May 6, 20; Jun. 3, 17.** Adv. Jul. 1, 15.	Apr. 8
Sep. 1.	Crane, Augusta, Ga.	Jul. 29
Sep. 1.	Garbage disposal, Chicago, Ill.	Aug. 12
Sep. 1.	R. R. Work, Purcell, Ind. Ter.	Aug. 19
Sep. 1.	Dredging, Columbus, O.	Aug. 19
Sep. 1.	Dredging, etc., New York, N. Y. Adv. Aug. 26.	Aug. 26
Sep. 1.	Levee, New Orleans, La.	Aug. 26
Sep. 2.	Brush mattress, Sacramento, Cal.	Aug. 26
Sep. 4.	Ditch, Prophetstown, Ill.	Aug. 26
Sep. 5.	Dredging, Oakland, Cal. Adv. Aug. 5 to 26.	Aug. 5
Sep. 5.	Supplies, Washington, D. C.	Aug. 12
Sep. 5.	Dredging, Mobile, Ala. Adv. Aug. 12 to 26.	Aug. 12
Sep. 5.	Canal, Miami, Fla. Adv. Aug. 12 to 26.	Aug. 12
Sep. 5.	Cement, Billings, Mont. Adv. Aug. 19.	Aug. 19
Sep. 5.	Supplies, Washington, D. C.	Aug. 26
Sep. 6.	Breakwater, Petoskey, Mich. Adv. Aug. 12 to 26.	Aug. 12
Sep. 6.	Culverts, Cleveland, O.	Aug. 19
Sep. 6.	Drain, etc., New Brighton, S. I., N. Y.	Aug. 26
Sep. 7.	Dredging, New York, N. Y. Adv. Aug. 12 to 26.	Aug. 12
Sep. 7.	Cement, etc., Brooklyn, N. Y.	Aug. 26
Sep. 7.	Supplies, New York, N. Y.	Aug. 26
Sep. 8.	Dredge pumps, etc., St. Louis, Mo. Adv. Aug. 12 to 26.	Aug. 12
Sep. 8.	Dredging, Nat'l Soldiers' Home, Va.	Aug. 26
Sep. 9.	R. R. work, Miami, Fla. Adv. July 15 to Aug. 26.	Jul. 29
Sep. 9.	Derrick, Guantanamo, Cuba	Aug. 12
Sep. 9.	Dredging, Charleston, S. C. Adv. Aug. 12 to 26.	Aug. 12
Sep. 9.	Canal, Forrest City, Ark.	Aug. 19
Sep. 9.	Pier Boston Mass.	Aug. 19
Sep. 9.	Dredge, New Orleans, La.	Aug. 19
Sep. 9.	Dredging, New York, N. Y.	Aug. 26
Sep. 9.	Ditch, Ft. Dodge, Ia.	Aug. 26
Sep. 11.	Ditch, Des Moines, Ia.	Aug. 26
Sep. 12.	Crane, San Francisco, Cal.	Aug. 12
Sep. 12.	Machine tools, etc., New Orleans, La.	Aug. 12
Sep. 12.	Dredging, New York, N. Y. (2 prop.) Adv. Aug. 19, 26.	Aug. 19
Sep. 12.	Cement, Panama	Aug. 26
Sep. 13.	Machine tools, etc., Panama	Aug. 19
Sep. 14.	Levee, England, Ark.	Aug. 26
Sep. 15.	Excav. canal, Riverton, Ala. Adv. Aug. 19, 26.	Aug. 19
Sep. 16.	Hoist, New York, N. Y.	Aug. 12
Sep. 19.	Supplies, Washington, D. C.	Aug. 26
Sep. 20.	Pier improv., Charlevoix, Mich. Adv. Aug. 26.	Aug. 26
Sep. 22.	Dam improv., Wheeling, W. Va.	Aug. 26
Oct. 3.	Supplies, San Francisco, Cal.	Aug. 26
Nov. 1.	**R. R. work, Manila, P. I.** Adv. Jul. 29.	**Jun. 17**
Nov. 9.	Wharf, etc., Havana, Cuba	Jul. 29
Jan. 1.	Statue plans, Indianapolis, Ind.	Jul. 22
Apr. 2,	**'06. Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Aug. 26.	**Apr. 29**
———	R. R. work, Trinity, Tex.	Aug. 12
———	R. R. work, Providence, Ky.	Aug. 26
———	Excav., Indianapolis, Ind.	Aug. 26

**Items marked thus give the names of parties awarded contracts.*